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Stock Assessment of Scup for 2011

by Mark Terceiro

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Stock Assessment of Scup for 2011

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EXECUTIVE SUMMARY

This assessment of the scup (*Stenotomus chrysops*) stock along the Atlantic coast (Massachusetts to North Carolina) is an update through 2010 of commercial and recreational fishery catch data, research survey indices of abundance, and the analyses of those data. The scup stock was not overfished and overfishing was not occurring in 2010 relative to the biological reference points established in the 2008 Northeast Data Poor Stocks (DPS) assessment. The fishing mortality rate (F) was estimated to be 0.040 in 2010, below the fishing mortality threshold reference point = FMSY = F40% = 0.177. Spawning Stock Biomass (SSB) was estimated to be 186,262 metric tons (mt) = 411 million lbs in 2010, above the biomass target reference point = SSBMSY = SSB40% = 92,044 mt = 203 million lbs.

Reported 2010 landings in the commercial fishery were 4,855 mt = 10.703 million lbs, about 3% under the commercial quota. Estimated 2010 landings in the recreational rod-and-reel fishery were 2,605 mt = 5.743 million lbs, about 85% over the recreational harvest limit. Total commercial and recreational landings in 2010 were 7,460 mt = 16.446 million lbs and total commercial and recreational discards were 2,417 mt = 5.329 million lbs, for a total catch in 2010 of 9,877 mt = 21.775 million lbs.

Spawning stock biomass (SSB) decreased from about 100,000 mt in 1963 to about 50,000 mt in 1969, then increased to about 75,000 mt during the late 1970s. SSB declined through the 1980s and early 1990s to less than 5,000 mt in the mid-1990s. With greatly improved recruitment and low fishing mortality rates since 1998, SSB increased to about greater than 100,000 mt = 220 million lbs since 2004. SSB was estimated to be 186,262 mt = 410 million lbs in 2010. There is a 50% probability that SSB in 2010 was between 178,000 and 192,000 mt (392 and 423 million lbs). Fishing mortality calculated from the average of the currently fully recruited ages (2-7+) varied between F = 0.1 and F = 0.3 during the 1960s and 1970s. Fishing mortality increased during the 1980s and early 1990s, peaking at about F = 1.0 in the mid-1990s. Fishing mortality decreased after 1994, falling to less than F = 0.1 since 2001, with F in 2010 = 0.040. There is a 50% probability that F in 2010 was between 0.032 and 0.048. Recruitment at age 0 averaged 92 million fish during 1963-1983, the period in which recruitment estimates are influenced mainly by the assessment model stock-recruitment relationship. Since 1984, recruitment estimates from the model are influenced mainly by the fishery and survey catches at age, and averaged 103 million fish during 1984-2010. The 1999, 2000, and 2008 year classes are estimated to be the largest of the time series, at 204, 222, and 212 million age 0 fish. The 2010 year class is estimated to be well below average at 44 million age 0 fish.

There is no consistent internal retrospective pattern in F, SSB, or recruitment evident in the 2011 updated assessment model. A between-assessment comparison provides another measure of assessment uncertainty due to changes in model estimates. The 2011 assessment estimates of SSB and F are intermediate with respect to the 2008 DPSWG assessment and 2009 update for the same years, and are very similar to those from 2010 update. The 2011 assessment estimates of the size of the 2007 and 2008 year classes are larger compared to previous assessments, while the estimates of the size of the 2006 and 2009 year classes are smaller.

If the landings of scup in 2011 equal the specified Total Allowable Landings (TAL) = 12,020 mt = 26.500 million lbs, the 2011 median (50% probability) discards are projected to be 1,471 mt = 3.243 million lbs, and the median total catch is projected to be 13,491 mt = 29.743 million lbs. The median F in 2011 is projected to be 0.097, below the fishing mortality threshold = FMSY = F40% = 0.177. The median SSB on June 1, 2011 is projected to be 178,008 mt = 392 million lbs, above the biomass target of SSBMSY = SSB40% = 92,044 mt = 203 million lbs.

If the total catches of scup in 2012 equal the July 2011 MAFMC recommended Annual Catch Target (ACT) = 24,200 mt = 53.352 million lbs, the 2012 median landings are projected to be 21,859 mt = 48.191 million lbs and the 2012 median discards are projected to be 2,341 mt = 5.161 million lbs. The median F in 2012 is projected to be 0.188, above the fishing mortality threshold = FMSY = F40% = 0.177. The median SSB on June 1, 2012 projected to be 168,235 mt = 371 million lbs, above the biomass target of SSBMSY = SSB40% = 92,044 mt = 203 million lbs.

If the stock is fished at the fishing mortality threshold = FMSY = F40% = 0.177 in 2012, median landings are projected to be 20,674 mt = 45.578 million lbs, with median discards of 2,217 mt = 4.689 million lbs, and median total catch = 22,897 mt = 50.479 million lbs. This projected median total catch is equivalent to the Overfishing Limit (OFL) for 2012, and is greater than MSY = 16,161 mt (35.629 million lbs) of total catch (13,134 mt = 28.956 million lbs of landings plus 3,027 mt = 6.673 million lbs of discards). The median SSB on June 1, 2012 is projected to be 168,711 mt = 372 million lbs, above the biomass target of SSBMSY = SSB40% = 92,044 mt = 203 million lbs.

BACKGROUND

Biology

Scup (*Stenotomus chrysops*) is a schooling continental shelf species of the Northwest Atlantic that is distributed primarily between Cape Cod and Cape Hatteras (Morse 1978). Scup undertake extensive migrations between coastal waters in summer and offshore waters in winter. Scup migrate north and inshore to spawn in spring, with larger scup (age 2 and older) tending to arrive in spring first, followed by smaller scup (Neville and Talbot 1964; Sisson 1974). Larger scup are found during the summer near the mouth of larger bays and in the ocean within 20-fathoms (120 feet = 37 meters), and often inhabit rough bottom areas. Smaller scup are more likely to be found in shallow, smooth bottom areas of bays during summer (Morse 1978). Scup migrate south and offshore in autumn as the water temperature decreases, arriving in offshore wintering areas by December (Hamer 1970; Morse 1978).

Spawning occurs from May through August and peaks in June. About 50% of age-2 scup are sexually mature (about 17 cm total length; Morse 1978), while nearly all scup of age 3 and older are mature. Scup reach a maximum fork length of at least 41 cm and a maximum age of at least 14 years, with a likely maximum of 20 years (Dery and Rearden 1979). The largest and oldest scup sampled in NEFSC surveys (1973, 1978) were fish 38-41 cm (fork length) and 14 years old. The largest and oldest scup in NEFSC commercial fishery samples (1974) was 40 cm (fork length) and 14 years old. The instantaneous natural mortality rate (M) for scup has been assumed to be 0.20 (Crecco *et al.* 1981, Simpson *et al.* 1990) in this and all previous stock assessments.

Fishery Management

The Mid-Atlantic Fishery Management Council (MAFMC) and Atlantic States Marine Fisheries Commission (ASMFC) jointly manage scup under Amendment 8 (1997) to the Scup, Scup, and Black Sea Bass Fishery Management Plan (FMP). The assessment and management unit includes all scup from Cape Hatteras, NC north to the US-Canada border. Tagging studies (e.g., Neville and Talbot 1964; Cogswell 1960, 1961; Hamer 1970, 1979) have indicated the possibility of two stocks of scup, one in Southern New England waters and another extending south from New Jersey waters. However, the lack of definitive locations for tag return data coupled with distributional data from the NEFSC bottom trawl surveys supports the concept of a single unit stock (Mayo 1982).

Amendment 8 to the FMP established a recovery plan for scup under which exploitation rates were to be reduced to 47% (F=0.72) during 1997-1999, to 33% (F=0.45) during 2000-2001, and to 21% (F=0.26) during 2002-2007. These goals were to be attained through implementation of a Total Allowable Catch (TAC) that included a commercial quota and a recreational harvest limit, commercial fishery minimum net mesh, trap vent and fish sizes and closed areas, and recreational fishery minimum fish sizes, possession limits, and closed seasons.

Amendment 12 (1998) to the FMP established a biomass threshold (a proxy for one-half BMSY) for scup based on the three-year moving average of the NEFSC spring bottom trawl survey index of Spawning Stock Biomass (SSB) during 1977-1979, which was perceived to be a period when the stock was near one-half BMSY. The scup stock was considered to be overfished

when the SSB index fell below a value of 2.77 SSB kg per tow. Amendment 12 defined overfishing for scup to occur when the fishing mortality rate exceeded the threshold fishing mortality of Fmax = 0.26 (as a proxy for FMSY).

Broad scale Gear Restricted Areas (GRAs) for scup were implemented in November 2000 under the framework provisions of the FMP to reduce discards of scup in small mesh fisheries for *Loligo* squid and silver hake. Two Northern Areas off Long Island were implemented for November through January, while a Southern Area off the mid-Atlantic coast was implemented for January through April. The size and boundaries of the GRAs were modified in late 2000 and again in 2005 in response to commercial fishing industry recommendations.

Amendment 14 (2007) to the FMP defined the biomass target and implemented a stock rebuilding plan for scup. The stock was to fully rebuild to the biomass target by January 1, 2015. The proxy for BMSY was two times the 3-year moving average of the NEFSC spring index of SSB during 1977-1979 noted earlier, or 2*2.77 = 5.54 SSB kg per tow. A target fishing mortality rate of F = 0.10 was to be applied in each year of a 7 year rebuilding period beginning in 2008. A TAC of 4,491 mt = 9.901 million lbs and corresponding Total Allowable Landings (TAL) of 3,329 mt = 7.339 million lbs were established for 2008 to achieve the target F.

The current overfished and overfishing definitions are based on revisions to the FMP through Framework 7 (2007) and use the values established in Amendments 12 (1998) and 14 (2007) as follows:

> The maximum fishing mortality threshold for each of the species under the FMP is defined as FMSY (or a reasonable proxy thereof) as a function of productive capacity, and based upon the best scientific information consistent with National Standards 1 and 2. Specifically, FMSY is the fishing mortality rate associated with MSY. The maximum fishing mortality threshold (FMSY) or a reasonable proxy may be defined as a function of (but not limited to): total stock biomass, spawning stock biomass, total egg production, and may include males, females, both, or combinations and ratios thereof which provide the best measure of productive capacity for each of the species managed under the FMP. Exceeding the established fishing mortality threshold constitutes overfishing as defined by the Magnuson-Stevens Act.
>
> The minimum stock size threshold for each of the species under the FMP is defined as one-half BMSY (or a reasonable proxy thereof) as a function of productive capacity, and based upon the best scientific information consistent with National Standards 1 and 2. The minimum stock size threshold (one-half BMSY) or a reasonable proxy may be defined as a function of (but not limited to): total stock biomass, spawning stock biomass, total egg production, and may include males, females, both, or combinations and ratios thereof which provide the best measure of productive capacity for each of the species managed under the FMP. The minimum stock size threshold is the level of productive capacity associated with the relevant one-half MSY level. Should the measure of productive capacity for the stock or stock complex fall below this minimum

threshold, the stock or stock complex is considered overfished. The target for rebuilding is specified as BMSY (or reasonable proxy thereof) at the level of productive capacity associated with the relevant MSY level, under the same definition of productive capacity as specified for the minimum stock size threshold.

Stock Assessment

A peer-reviewed assessment including an analytical population model was accepted in 1995 by SAW 19 (NEFSC 1995). The assessment featured a virtual population analysis (VPA) modeled in the ADAPT framework (Conser and Powers 1990), with commercial and recreational landings and discards at age estimates, and with state and NEFSC abundance indices used for calibration. The 1995 SAW 19 assessment indicated that F in 1993 was 1.3, and SSB was 4,600 mt = 10.141 million lbs. A yield per recruit (YPR) analysis indicated that Fmax = 0.236.

The VPA was updated through 1996 and reviewed by the 1997 SAW 25 (NEFSC 1997), but due to concerns over the low intensity of fishery length sampling in the 1990s, uncertainty about the magnitude of commercial discards in the late 1990s, and the ongoing high variability and imprecision of survey indices, the VPA was not accepted as a basis for management decisions. Assessment conclusions were therefore based primarily on trends in NEFSC and state agency survey indices and catch curve analyses using those survey data. The 1997 SAW 25 was able to conclude that in 1996 scup were over-exploited and near record low abundance levels.

The scup assessment was next updated through 1997 and reviewed by the 1998 SAW 27 (NEFSC 1998). Several configurations of a surplus production model (ASPIC; Prager 1994) were reviewed in addition to an updated VPA, but like the VPA, the production model results were not accepted due to concerns over the validity of the input fishery and survey data. An updated YPR analysis was accepted and indicated that Fmax = 0.26. The 1998 SAW 27 concluded that a VPA or other analytical model formulation for scup would not be feasible until the quality of the input data, particularly the precision of discard estimates, was significantly improved and that scup was over exploited and at a low biomass level.

The 1998 SAW 27 Panel recommended the scup assessment be based on the long-term time series of NEFSC trawl survey indices and fishery catches. The Panel noted that commercial landings were sustained at about 19,000 mt = 41.888 million lbs annually during the mid-1950s to mid-1960s, and concluded that the stock was likely near BMSY during that period (Figure 1). The nearest subsequent peak in NEFSC survey indices occurred in the late 1970s. Commercial and total fishery catches in the late 1970s were about one-half of those in the 1950s to 1960s, and so the late 1970s were identified as a period when the stock was likely to have been near one-half of BMSY. The Panel considered the NEFSC spring survey series to be most representative of SSB, since older ages were better represented in the age structure than in the NEFSC fall survey or other state agency surveys. The 1998 SAW 27 Panel recommended that the three-year moving average of the NEFSC spring bottom trawl survey index of SSB during 1977-1979 (2.77 SSB kg per tow) be used as the proxy biomass threshold (one-half BMSY) and that Fmax = 0.26 be used as the proxy fishing mortality threshold (FMSY). Those recommendations were subsequently adopted for the biological reference points in Amendment 12 to the FMP.

The scup assessment was next updated through 1999 and reviewed by the 2000 SAW 31 (NEFSC 2000). The assessment continued to be based on trends in research survey indices and fishery catches and indicated that the stock was overfished and that overfishing was occurring. The stock assessment was reviewed again by the 2002 SAW 35 and included fishery data through 2001 (NEFSC 2002). The assessment was again based on trends in research survey indices and fishery catches, but indicated that the stock was no longer overfished, although the 2002 SAW 35 Panel concluded that stock status with respect to the overfishing definition could not be evaluated due to the uncertainty of F estimates derived from research survey catch curve calculations. The 2002 SAW 35 Panel found sufficient evidence to conclude that the relative exploitation rates had declined in recent years and that survey observations indicated strong recruitment and some rebuilding of age structure.

During 2002-2008, the status of the stock was evaluated by the MAFMC Monitoring Committee using trends in research survey indices and fishery catches. A relative exploitation index based on the annual total fishery landings and the NEFSC spring three-year average SSB index was used as a proxy for F to monitor status with respect to overfishing and provide guidance to the specification of the annual TAC. A projection of the NEFSC spring survey SSB index using assumptions about maturity, partial recruitment to the survey, and the level of future recruitment as indexed by the NEFSC spring survey at age 1 was used in Amendment 14 to the FMP to forecast stock rebuilding and set the F target for 2008-2105. An update to the status monitoring metrics was completed in 2008 to aid in the specification of fishery regulations for 2009. The update indicated that while the stock was overfished in 2007, the exploitation rate was at about the F target, suggesting that overfishing was not occurring in 2007. However, the stock rebuilding progress was slower than forecast by the Amendment 14 projection, with the NEFSC spring 2007 SSB index (three-year average = 1.16 kg per tow) at only 56% of the projected 2007 index (2.08 kg per tow).

The most recent peer review of the scup assessment was conducted by the 2008 Northeast Data Poor Stocks (DPS) Peer Review Panel (NEFSC 2009), which accepted an ASAP statistical catch at age (SCAA) model (NFT 2008) as the basis for biological reference points and status determination, with fishery and survey catch data through 2007. The new model of scup population dynamics was expected to provide a more stable tool for monitoring stock status and specifying annual fishery regulations than the previous single index-based model. The assessment indicated that the stock was not overfished and overfishing was not occurring in 2008, relative to the revised biological reference points. Fishing mortality was estimated to have decreased rapidly after 1994, with F in 2007 = 0.054. With greatly improved recruitment and relatively low fishing mortality rates since 1998, SSB was estimated to have steadily increased to about 119,300 mt = 263 million lbs in 2007. There was no consistent retrospective pattern in F, SSB, or recruitment evident in the 2008 assessment model. This 2011 assessment update uses the same model configuration as the 2008 DPS (NEFSC 2009) benchmark and 2009-2010 updated assessments (Terceiro 2009, 2010), with fishery and survey catch information through 2010. This 2011 evaluation of stock status is made with respect to the 2008 DPS biological reference points.

COMMERCIAL LANDINGS

US total commercial landings averaged over 18,000 mt per year from 1950 to 1965, peaking at over 22,000 mt in 1960, and then decreased to less than 10,000 mt per year in the late 1960s. Landings fluctuated between about 5,000 and 10,000 mt from 1970 to the early 1990s and then decreased to about 1,200 mt in 2000, less than 6% of the peak observed in 1960. Commercial landings have since increased to average about 4,000 mt during 2003-2010 (Figure 1). Reported 2010 landings in the commercial fishery were 4,855 mt = 10.703 million lbs, about 3% under the commercial quota. About eighty percent of the commercial landings of scup for the period 1979-2010 were in Rhode Island (38%), New Jersey (26%), and New York (16%; Table 1). The otter trawl is the principal commercial fishing gear, accounting for about 75% of the total catch during 1979-2010 (Table 2). The remainder of the commercial landings is taken by floating trap (11%) and hand lines (7%), with paired trawl, pound nets, and pots and traps each contributing between 1 and 4%.

COMMERCIAL DISCARDS

The NEFSC Fishery Observer Program has collected information on landings and discards in the commercial fishery since 1989. Northeast Region (NER; ME-VA) discard estimates were raised to account for North Carolina landings. A discard mortality rate of 100% was assumed because there are no published estimates of scup discard mortality rates. This assumption is based on limited observations and is a point of contention between scientists and fishermen. Previous peer reviews of the assessment have recommended that research be conducted to better characterize the discard mortality rate of scup in different gear types in order to more accurately quantify the absolute magnitude of scup discard mortality (NEFSC 1995, 1997, 1998, 2000, 2002, 2009). Quantifying discards from the commercial fishery is necessary for a reliable scup assessment, but low sample sizes in the past have resulted in uncertain estimates. Despite the uncertainty of the discard data, recent peer review panels have concluded that commercial discarding of scup has been high during most of the last 20 years, generally approaching or exceeding the commercial landings. Since the implementation of the GRAs in 2000, estimated discards as a proportion of the total commercial catch have decreased, averaging 35%-40%.

Commercial discards for scup are estimated using geometric mean discards to landings (GMDL) ratios. Ratios of discards to landings by landings level (for trip landings < 300 kg (661 lbs), the bycatch fishery; or => 300 kg, the directed fishery) and half-year are calculated and multiplied by corresponding observed landings from the NEFSC Dealer Report database to provide estimates of discards. Geometric mean rates (re-transformed, uncorrected, mean ln-transformed Discards to Landings per trip) are used because the distributions of landings, discards and the ratio of discards to landings on a per-trip basis in the scup fishery are highly variable and positively skewed. Observed trips with both scup landings and discard were used to calculate per trip discard to landings ratios. Only trips with both non-zero landings and discards could be used for this approach to avoid division by zero. The number of trawl gear trips used to calculate geometric mean discard-to-landings ratios (GMDL) by half year for 1997-2008 ranged

from 1 to 104 for trips < 300 kg and from 1 to 35 for trips =>300 kg, with the best sampling occurring since 2003. No trawl gear trips were available for half year two in 1997 and 1999 for trips < 300 kg and for half year two in 1997-2001 for trips => 300 kg. The ratio calculated for half year one was used to estimate discards for half year two when no trawl gear trips were available in half year two. The ratios ranged from 0.03 in 2004 (half year two, trips => 300 kg) to 121.71 in 1998 (half year one, trips => 300 kg; Table 3).

The large 1998 directed fishery ratio and subsequent very high annual discard estimate (111,973 mt) was based on one trawl gear trip. About 93% of the discard from that trip was attributable to a single tow in which an estimated 68.2 mt (150,000 lbs.) of scup were captured. This tow was not lifted from the water and the captain of the vessel estimated the weight of the catch. There has been debate concerning the validity of the catch weight estimate and whether or not it was representative of other vessels or trips in the fishery. However, the observation was reported by a trained NEFSC observer and was therefore included in the initial calculation of the estimate of scup discards (Tables 3-4). Peer reviews of the assessment have since concluded that the 1998 estimate is infeasible, and it has been replaced by the mean of the 1997 and 1999 estimates (3,331 mt) in subsequent tabulations of catch and in subsequent modeling (Tables 5, 9).

RECREATIONAL CATCH

Scup is the object of a major recreational fishery, with the greatest proportion of catches taken in the states of Massachusetts, Rhode Island, Connecticut and New York. Estimates of the recreational catch in numbers were obtained from the NMFS Marine Recreational Fishery Statistics Survey (MRFSS) for 1981-2010. These estimates were available for three categories: type A - fish landed and available for sampling, type B1 - fish landed but not available for sampling and type B2 - fish caught and released. The estimated recreational landings (types A and B1) in weight during 1981-2010 averaged about 2,000 mt per year (Table 5). Estimated 2010 landings in the recreational rod-and-reel fishery were 2,605 mt = 5.743 million lbs, about 85% over the recreational harvest limit. Since 1981, the recreational landings have averaged 30% of the commercial and recreational landings total.

The estimated recreational discard in weight during 1984-2010 ranged from 6 mt in 1999 to a high of 393 mt in 2006, averaging about 100 mt per year (Table 5). The weight of discards has been directly calculated only for those years (1984 and later) for which recreational catch at age has been compiled. In compilations of total fishery catch for earlier years, the recreational discards was assumed to be approximately 2% of the estimated recreational landings, based on the mean discard percentage for 1984-1996, the time period with catch at age estimates before the implementation of the FMP. No length frequency samples of the scup discard were collected under the MRFSS program before 2005, so recreational discards were assumed to be fish aged 0 and 1, in the same relative proportions and with the same mean weight as the landed catch less than state regulated minimum fish sizes. An inspection of discard length frequency samples from the New York recreational fishery for 1989-1991 indicated that this assumption was reasonable. Since 2005 length samples of the recreational fishery discard collected in the MRFSS For-Hire Survey sampling have been used the characterize the size frequency of the discard.

The discard mortality rate in the recreational fishery has been reported to range from 0-15% (Howell and Simpson 1985) and from 0-14% (Williams, pers. comm.). Howell and Simpson (1985) found mortality rates were positively correlated with size, due mainly to the tendency for larger fish to take the hook deep in the esophagus or gills. Williams more clearly demonstrated increased mortality with depth of hook location, as well as handling time, but found no association with fish size. Based on these studies, a discard mortality rate in the recreational fishery of 15% has been used in this and previous assessments.

COMMERCIAL FISHERY LANDINGS AT LENGTH AND AGE

The NER commercial fishery length frequency sampling is summarized in Table 6. Annual sampling intensity has varied from 18 to 687 mt per 100 lengths, with sampling exceeding the informal threshold criterion of 200 mt per 100 lengths since 1994. For this assessment, commercial fishery landings at age beginning in 1984 have been updated through 2010, with samples generally pooled by market category (pins/small, medium, large/mix, jumbo, and unclassified) and by half-year (January-June, July-December); samples were pooled on a quarterly basis (e.g., January-March) for 2004-2010. Estimates of commercial fishery landings at age (Figure 2) and mean weights at age are presented in Tables 7-8.

COMMERCIAL FISHERY DISCARDS AT LENGTH AND AGE

The intensity of length sampling of discarded scup from the NEFSC Fishery Observer Program declined in 1992-1995 relative to 1989-1991 (Table 9). Sampling intensity ranged from 489 to 335 mt per 100 lengths sampled in 1992-1995, failing to meet the informal criterion of 200 mt per 100 lengths. Sampling intensity improved to 100 mt per 100 lengths in 1996, but then declined to over 200 mt per 100 lengths in 1997-1999. Sampling intensity has generally met the 200 mt per 100 lengths threshold since 2000. The mean weight of the discard was estimated from length frequency data using a length-weight equation, total numbers discarded were then estimated by dividing total weight by mean weight, and numbers at length were then calculated from the length-frequency distribution. Discards at length were aged using a combination of commercial and survey age-length keys, with discards at age dominated by fish aged 0, 1, or 2, depending on the year under consideration. Estimates of commercial fishery discards at age (Figure 3) and mean weights at age are presented in Tables 10-11.

RECREATIONAL FISHERY LANDINGS AT LENGTH AND AGE

For the recreational fishery, length sampling intensity has varied from 45 to 471 mt per 100 lengths. Sampling in all years except one (1984) during 1981-1987 failed to satisfy the above criterion, but since 1987 the criterion has been met except for 1999-2000 (Table 12). Numbers at length for recreational landings were determined from recreational fishery length samples pooled by half-years (January-June; July-December) over all regions and fishing modes, and were converted to numbers at age by applying half-year age-length keys constructed from NEFSC commercial and survey samples. Age-length keys from spring surveys and first and

second quarter commercial samples were applied to numbers at length from the first half of the year, while age-length keys from fall surveys and third and fourth quarter commercial samples were applied to numbers at length from the second half of the year. Estimates of recreational fishery landings at age (Figure 4) and mean weights at age are presented in Tables 13-14.

RECREATIONAL FISHERY DISCARDS AT LENGTH AND AGE

As noted earlier, no length samples of the discard were routinely collected under the MRFSS program prior to 2005, so recreational discards were assumed to be fish less than state minimum sizes, in the same relative proportions at length as the landed catch less than the respective state minimum sizes (i.e., sub-legal fish). This assumption for the coastwide fishery is supported by discard length frequency samples from the New York recreational fishery (1989-1991) and samples collected since 2005 by the MRFSS For-Hire Survey. Since 2005, the MRFSS For-Hire Survey discard samples have been used in concert with the MRFSS sub-legal landed lengths to characterize the length frequency of the recreational discard. Numbers at length were converted to numbers at age by applying half-year (January-June; July-December) age-length keys constructed from NEFSC commercial and survey samples. As noted earlier, a 15% discard mortality rate is assumed. Estimates of recreational fishery discards at age (Figure 5) and mean weights at age are presented in Tables 15-16.

TOTAL FISHERY CATCH

Estimates of the total fishery catch at age and mean weights at age for 1984-2010 (the time series is limited by the availability of sampled fishery ages) are presented in Tables 17-18. Total commercial and recreational landings in 2010 were 7,460 mt = 16.446 million lbs and total commercial and recreational discards were 2,417 mt = 5.329 million lbs, for a total catch in 2010 of 9,877 mt = 21.775 million lbs (Table 5). An extended time series of the total catch of scup has been estimated to provide an historical perspective of the exploitation of scup in the years before fishery aging data were available (Table 19). These estimates include commercial and recreational landings and discards. The catches before 1981 are the least reliable due to uncertainty about a) the magnitude of domestic commercial fishery discards, b) the magnitude of the distant water fleet (DWF) catch and c) the uncertainty of assumptions made to estimate the recreational catch (50% reduction from interpolations made in Mayo 1982 for 1960-1978; recreational discards assumed to be 2% of the adjusted recreational landings). For years in which no commercial fishery observer data were collected (prior to 1989), commercial discards were estimated using the mean of landings to discards ratios for 1989-2001.

RESEARCH SURVEY INDICES OF ABUNDANCE

Northeast Fisheries Science Center

The NEFSC spring and fall bottom trawl surveys provide long time series of fishery-independent indices for scup. The NEFSC spring and fall surveys are conducted annually during

March-May and September-November, ranging from just south of Cape Hatteras, NC to Canadian waters. NEFSC spring and fall abundance and biomass indices for scup exhibit considerable inter-annual variability (Table 20, Figure 6). NEFSC spring survey catches are characterized mainly by scup of ages 1 and 2 (Figure 7), while the fall survey often captures large numbers of age 0 and 1 fish (Figure 8).

The Fisheries Survey Vessel (FSV) *Albatross IV* (ALB) was replaced in spring 2009 by the FSV *Henry B. Bigelow* (HBB) as the main platform for NEFSC research surveys, including the spring and fall bottom trawl surveys. The size, towing power, and fishing gear characteristics of the HBB are significantly different from the ALB, resulting in different fishing power and therefore different survey catchability. Calibration experiments to estimate these differences were conducted during 2008 (Brown 2009), and the results of those experiments were peer reviewed by a Panel of three non-NMFS scientists during the summer of 2009 (Anonymous 2009, Miller et al. 2010). The terms of reference for the Panel were to review and evaluate the suite of statistical methods used to derive calibration factors by species before they were applied in a stock assessment context. Following the advice of the August 2009 Peer Review (Anonymous 2009), the methods proposed in Miller et al. (2010), and the precedents set in peer-reviews of stock assessments for haddock (Van Eeckhaute and Brooks 2010), yellowtail flounder (Legault et al. 2010), silver and red hake (NEFSC 2011a), and winter flounder (NEFSC 2011b), aggregate and length-based calibration factors were used to convert 2009-2011 spring and fall HBB survey catch number and weight indices to ALB equivalents for use in this stock assessment update (Tables 21-23; Figure 6).

The NEFSC survey indices sometimes appear to mainly reflect the availability of scup to the survey, rather than true abundance, making it difficult to interpret large inter-annual changes in the indices. For example, the 2002 spring biomass index was about twice the second highest spring index, which was observed in 1977 (Figure 6). The spring numeric abundance indices are similar; the 2002 index is the highest observed in the series and about twice the 1970 index. These dramatic increases were evident across all ages in the estimated 2002 spring numbers at age (Table 24; Figure 7). However, the previous fall survey estimates of numbers at age in 2001 had not reflected relatively large values from which the corresponding 2002 spring numbers at age might have been expected to derive (Table 25, Figure 8) nor did they subsequently translate to exceptional indices of biomass in fall 2002 or spring 2003. Spring survey biomass and abundance indices decreased subsequent to 2002, but are still above the low values of the late 1990s. Fall survey abundance and biomass, although highly variable, have about doubled since the late 1990s.

The NEFSC winter survey was started in 1992 primarily as a flatfish survey, was conducted during February, and ranged from Cape Hatteras, NC to the southwestern part of Georges Bank. The winter survey 2002 abundance and biomass indices were, like the spring survey, the largest of the time series (Table 26, Figure 6). Similar to the spring estimates, numbers at age estimated for the 2002 winter survey were also exceptionally large (Table 27, Figure 9). Winter survey abundance and biomass decreased subsequent to 2002, but were still above the low values of the late 1990s. The winter trawl series ended in 2007.

The large differences in the absolute magnitude of NEFSC survey catches of ages 0-2 compared to those of fish at ages 3 and older suggests a substantial difference in survey selection at age between these two aggregate age groups. In the 2008 DPS assessment (NEFSC 2009),

aggregate biomass indices retracted to the lengths of fish ages 0-2 were constructed for calibration of those ages in the population model (maximum length of 22 cm in the winter, 20 cm in the spring, and 23 cm in the fall series). The 2009-2011 HBB values for these aggregate indices have also been converted to ALB equivalents using length calibration factors (Table 28).

Massachusetts Division of Marine Fisheries

The Massachusetts Division of Marine Fisheries (MADMF) has conducted spring and fall bottom trawl surveys of Massachusetts territorial waters in May and September since 1978. Survey coverage extends from the New Hampshire to Rhode Island boundaries and seaward to three nautical miles, including Cape Cod Bay and Nantucket Sound. The study area is stratified into geographic zones based on depth and area. The MADMF spring survey catches are characterized mainly by scup of ages 1 and 2, while the fall survey often captures large numbers of age 0 fish. The spring biomass and abundance indices decreased sharply from a high in the early 1980s to relatively low levels through the 1990s, and have since exhibited a variable but increasing trend (Table 29, Figure 10). The MADMF fall abundance index can include large numbers of age 0 fish and therefore can be more variable as it reflects inter-annual variance in recruitment. The fall biomass index exhibits an increasing trend since the mid 1990s (Table 29, Figure 10).

Rhode Island Division of Fish and Wildlife

The Rhode Island Division of Fish and Wildlife (RIDFW) has conducted spring and fall bottom trawl surveys based on a stratified random sampling design since 1979. Three major fishing grounds are considered in the spatial stratification, including Narragansett Bay, Rhode Island Sound, and Block Island Sound. Stations are either fixed or randomly selected for each stratum. The RIDFW spring survey mainly catches scup of ages 1 and 2. The spring index shows relatively low scup abundance and biomass through 1999 followed by a steep increase during 2000-2002, in common with the NEFSC and MADMF indices, and high variability since then (Table 30; Figure 11). The RIDFW fall survey is dominated by age 0 scup, and the fall indices show a general increase to a 1993 peak, followed by a steep decline until 1998, and a steady increase since then. The fall series reached a time series peak in 2009 (Figure 11).

The RIDFW implemented a ventless trap survey in cooperation with commercial fishermen beginning in 2005. The cooperative trap survey has a fixed station format, and survey catches are expressed as catch per trap soak hour. The index of age 0 scup from the trap indicates strong recruitment in 2007 and 2010, while the aggregate index of scup abundance has increased steadily since 2005 (Table 31; Figures 11-12). The RIDFW cooperative trap survey data have not yet been included in the calibration of the assessment population model.

Connecticut Department of Enivornmenta Protection

The Connecticut Department of Environmental Protection (CTDEP) trawl survey program was initiated in May 1984 and encompasses both New York and Connecticut waters of Long Island Sound. The stratified random design survey is conducted in the spring (April-June) and fall (September-October). The CTDEP spring index indicates relatively low abundance through most of the survey period, but have increased substantially since 1999 (Table 32, Figure

13). The CTDEP fall survey, which often catches large numbers of age-0 scup, indicates that recruitment was relatively stable during most of the survey period, but the aggregate fall indices have also increased substantially since 1999. (Table 33, Figures 12-13) Due to vessel engine failure, no complete spring or fall surveys were conducted in 2010. The age compositions of the CTDEP spring and fall surveys generally include a higher proportion of age 2 and older fish than the other state or NEFSC surveys (Figures 14-15).

New York Department of Environmental Conservation

The New York Department of Environmental Conservation (NYDEC) initiated a small mesh trawl survey in 1985 to collect fisheries-independent data on the age and size composition of scup in local waters. This survey is conducted in the Peconic Bays, the estuarine waters which lie between the north and south forks of eastern Long Island. The NYDEC survey provides age 0, 1, and 2+ indices of scup abundance. The age 0 indices are generally low over the survey period, with peaks in 2000, 2002, 2003, 2006, and 2007 that may indicate recruitment of strong cohorts in those years (Table 34, Figure 12). In the early years of the survey there often has not been a strong correspondence between the age 0 indices and age 1 and 2+ indices in the following years (Figure 16).

New Jersey Bureau of Marine Fisheries

The New Jersey Bureau of Marine Fisheries (NJBMF) conducts a stratified random bottom trawl survey of New Jersey coastal waters from Ambrose Channel south to Cape Henlopen Channel. Latitudinal strata boundaries correspond to those in the NEFSC trawl survey; longitudinal boundaries correspond to the 30, 60, and 90 foot isobaths. Each survey includes two tows per stratum plus one additional tow in each of nine larger strata for a total of 39 tows. The NJBMF survey indices exhibit variable patterns over the early part of the time series. The biomass index reached a minimum in 1996 and then generally increased, peaking in 2007 (Table 34; Figure 17).

University of Rhode Island Graduate School of Oceanography (URIGSO)

University of Rhode Island Graduate School of Oceanography (URIGSO) has conducted a standardized, two-station trawl survey in Narragansett Bay and Rhode Island Sound since the 1950s, with consistent sampling since 1963. Irregular length-frequency samples for scup indicate that most of the survey catch is of fish from ages 0 to 2. The aggregate numbers-based index reached a peak in the late 1970s, was relatively low during the late 1990s, and has since generally increased. The 2009 index was the second highest of the time series, after the 1976 value (Table 35, Figure 18).

Virginia Institute of Marine Science (VIMS)

Juvenile Fish Trawl Survey

The Virginia Institute of Marine Science (VIMS) has conducted a juvenile fish trawl survey in lower Chesapeake Bay during June-September since 1988. The VIMS age-0 scup

indices show a general decline in recruitment from relatively high levels with peaks in the late 1980s to early 1990s, to relatively low levels from the late 1990s to early 2000s, and the indication of several recent strong year classes (Table 34, Figure 12).

Chesapeake Bay Multispecies Monitoring and Assessment Program Trawl Survey

The VIMS Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP) trawl survey is designed to support bay-specific stock assessment activities at both a single and multispecies scale. While no single gear or monitoring program can collect all of the data necessary for quantitative assessments, ChesMMAP was designed to fulfill data gaps by maximizing the biological and ecological data collected for several recreationally and commercially important species in the bay. Total abundance and biomass indices composed mainly of age 0 and 1 fish are available since 2002, and suggest strong recruitment in 2005 and 2010 (Table 36, Figure 19).

NEAMAP Trawl Survey

The VIMS NEAMAP industry-cooperative survey was started in fall 2006, providing research survey samples in the spring and fall seasons along the Atlantic coast from Rhode Island to North Carolina, in depths of 20-90 feet (9-43 meters). The NEAMAP survey data have not yet been included in the calibration of the assessment population model (Table 37, Figure 19).

2011 Updated Fishing Mortality Rate and Stock Size Estimates

Fishing mortality rates and stock sizes were estimated using the ASAP SCAA model (NFT 2008a). The catch at age, mean weight at age, maturity at age, and survey index calibration time series were input as in the 2008 DPS and 2009-2010 updated assessments (NEFSC 2009, Terceiro 2009, 2010). Winter, spring, and mid-year survey indices and all survey recruitment (age-0) indices were compared to population numbers of the same age at the beginning of the same year. Fall survey indices were compared to population numbers one year older at the beginning of the next year. Lognormal error distributions were assumed for the total catch in weight, research survey catch at age calibration indices, internal Beverton-Holt stock-recruitment relationship and parameters, selectivity parameters, annual fishing mortality parameters, survey catchability parameters, and estimated stock numbers at age. A multinomial distribution was assumed for fishery catch at age. Additional model settings including specification of likelihood component emphasis factors (lambdas), size of the deviation factors expressed as standard deviations and penalty functions for extreme fishing mortality estimates were left at the consensus values set in the 2008 DPS assessment.

Summary estimates, estimated January 1 stock size at age in numbers, and estimated fishing mortality (F) at age from the 2011 updated model for 1984-2010 (the years with input fishery catches at age) are provided in Tables 38-40. Spawning stock biomass (SSB) decreased from about 100,000 mt in 1963 to about 50,000 mt in 1969, then increased to about 75,000 mt

during the late 1970s. SSB declined through the 1980s and early 1990s to less than 5,000 mt in the mid-1990s. With greatly improved recruitment and low fishing mortality rates since 1998, SSB increased to about greater than 100,000 mt = 220 million lbs since 2004. SSB was estimated to be 186,262 mt = 410 million lbs in 2010 (Figures 20-21). There is a 50% probability that SSB in 2010 was between 178,000 and 192,000 mt (392 and 423 million lbs; Figure 22). Fishing mortality calculated from the average of the currently fully recruited ages (2-7+) varied between F = 0.1 and F = 0.3 during the 1960s and 1970s. Fishing mortality increased during the 1980s and early 1990s, peaking at about F = 1.0 in the mid-1990s. Fishing mortality decreased after 1994, falling to less than F = 0.1 since 2001, with F in 2010 = 0.040 (Figure 23). There is a 50% probability that F in 2010 was between 0.032 and 0.048 (Figure 24).

Recruitment at age 0 averaged 92 million fish during 1963-1983, the period in which recruitment estimates are influenced mainly by the assessment model stock-recruitment relationship. Since 1984, recruitment estimates from the model are influenced mainly by the fishery and survey catches at age, and averaged 103 million fish during 1984-2010. The 1999, 2000, and 2008 year classes are estimated to be the largest of the time series, at 204, 222, and 212 million age 0 fish. The 2010 year class is estimated to be well below average at 44 million age 0 fish (Figures 20-21).

There is no consistent internal retrospective pattern in F, SSB, or recruitment evident in the 2011 updated assessment model for terminal years since 2003 (Figures 25-27). A between-assessment comparison provides another measure of assessment uncertainty due to changes in model estimates. The 2011 assessment estimates of SSB and F are intermediate with respect to the 2008 DPSWG assessment and 2009 update for the same years, and are very similar to those from 2010 update. The 2011 assessment estimates of the size of the 2007 and 2008 year classes are larger compared to previous assessments, while the estimates of the size of the 2006 and 2009 year classes are smaller (Figures 28-30).

2008 DPS ASSESSMENT BIOLOGICAL REFERENCE POINTS

The 2008 DPS Peer Review Panel accepted the ASAP SCAA model results as the basis for biological reference points and status determination for scup (NEFSC 2009). Reference points were calculated using the non-parametric yield and SSB per recruit/long-term projection approach adopted for summer flounder (NEFSC 2008a) and the New England groundfish stocks (NEFSC 2008b). In the yield and SSB per recruit calculations, the most recent five year averages were used for mean weights and fishery partial recruitment pattern. For the estimation of MSY and SSBMSY, the cumulative distribution function of the 1984-2007 recruitments (corresponding to the period of input fishery catches at age) was re-sampled to provide future recruitment estimates (mean = 117 million age 0 fish). The 2008 DPS Peer Review Panel recommended F40% as the proxy for FMSY, and the corresponding SSBF40% as the proxy for SSBMSY. The F40% proxy for FMSY = 0.177, the proxy estimate for SSBMSY = SSB40% = 92,044 mt = 202.922 million lbs, and the proxy estimate for MSY = MSY40% = 16,161 mt = 35.629 million lbs (13,134 mt = 28.956 million lbs of landings and 3,027 mt = 6.673 million lbs of discards).

2011 UPDATED STOCK STATUS

The scup stock was not overfished and overfishing was not occurring in 2010 relative to the biological reference points established in the 2008 Northeast Data Poor Stocks (DPS) assessment. The fishing mortality rate (F) was estimated to be 0.040 in 2010, below the fishing mortality threshold reference point = FMSY = F40% = 0.177. Spawning Stock Biomass (SSB) was estimated to be 186,262 metric tons (mt) = 411 million lbs in 2010, above the biomass target reference point = SSBMSY = SSB40% = 92,044 mt = 203 million lbs (Figure 31).

ASSESSMENT UNCERTAINTY CONSIDERATIONS

The 2011 assessment indicates that the stock was well above the biomass target and being fished at well below the fishing mortality threshold in 2010. The high level of 2010 stock abundance is the result of historically low fishing mortality rates and historically high levels of recruitment since the late 1990s. The MSY proxy in terms of total catch is 16,161 mt (35.628 million lbs), with total landings of 13,134 mt (28.956 million lbs) and total discards of 3,027 mt (6.673 million lbs). The extended catch series estimated for scup (Table 19) indicates that this MSY proxy is a feasible estimate. Total fishery catch is estimated to have averaged about 34,000 mt (~75 million lbs) during 1960-1965, while reported commercial landings alone averaged about 19,000 mt (~42 million lbs) in that period. Therefore, the MSY estimate appears feasible given historical evidence from the fishery. The 2008 DPS Peer Review Panel (NEFSC 2009) advised that a gradual increase in the ABC toward the MSY level would facilitate an evaluation of the performance of the new assessment model and reference points in monitoring stock status, while reducing the risk to the stock due to rapidly increased catch.

PROJECTIONS

Stochastic projections were made to provide forecasts of stock size and catches in 2010 consistent with the 2008 DPS assessment biological reference points. The projections assume that recent (2005-2010) patterns of discarding will continue over the time span of the projections. Different patterns that could develop in the future due to different trip and bag limits and fishery closures have not been evaluated. One hundred projections were made for each of the 1000 MCMC realizations of 2011 stock sizes from the 2011 updated assessment results using NFT AGEPRO version 4.0.5 (NFT 2011). Future recruitment at age 0 was generated randomly from a cumulative density function of the 2011 updated recruitment series for 1984-2010 (mean recruitment = 103 million fish). The projected catch estimates in the following text-tables are percentile intervals of the catch distributions for fixed F.

If the landings of scup in 2011 equal the specified Total Allowable Landings (TAL) = 12,020 mt = 26.500 million lbs, the 2011 median (50% probability) discards are projected to be 1,471 mt = 3.243 million lbs, and the median total catch is projected to be 13,491 mt = 29.743 million lbs. The median F in 2011 is projected to be 0.097, below the fishing mortality threshold = FMSY = F40% = 0.177. The median SSB on June 1, 2011 is projected to be 178,008 mt = 392 million lbs, above the biomass target of SSBMSY = SSB40% = 92,044 mt = 203 million lbs.

If the total catches of scup in 2012 equal the July 2011 MAFMC recommended Annual Catch Target (ACT) = 24,200 mt = 53.352 million lbs, the 2012 median landings are projected to be 21,859 mt = 48.191 million lbs and the 2012 median discards are projected to be 2,341 mt = 5.161 million lbs. The median F in 2012 is projected to be 0.188, above the fishing mortality threshold = FMSY = F40% = 0.177. The median SSB on June 1, 2012 projected to be 168,235 mt = 371 million lbs, above the biomass target of SSBMSY = SSB40% = 92,044 mt = 203 million lbs.

If the stock is fished at the fishing mortality threshold = FMSY = F40% = 0.177 in 2012, median landings are projected to be 20,674 mt = 45.578 million lbs, with median discards of 2,217 mt = 4.689 million lbs, and median total catch = 22,897 mt = 50.479 million lbs. This projected median total catch is equivalent to the Overfishing Limit (OFL) for 2012, and is greater than MSY = 16,161 mt (35.629 million lbs) of total catch (13,134 mt = 28.956 million lbs of landings plus 3,027 mt = 6.673 million lbs of discards). The median SSB on June 1, 2012 is projected to be 168,711 mt = 372 million lbs, above the biomass target of SSBMSY = SSB40% = 92,044 mt = 203 million lbs.

Total Catch, Landings, Discards, Fishing Mortality (F)
and Spawning Stock Biomass (SSB) in 2012
Catches and SSB in metric tons

Total Catch	Landings	Discards	F	SSB
24,200	21,859	2,341	0.188	168,235
22,897	20,674	2,217	0.177	168,711

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Table 1. Commercial landings (metric tons; mt) of scup by state. One mt was landed in DE in 1995, included with MD 1995 total. Eight mt were landed in PA in 2004 included with MD 2004 total. Landings include revised Massachusetts landings for 1986-1997.

Year	ME	MA	RI	CT	NY	NJ	MD	VA	NC	Total
1979		782	3,123	92	1,422	2,159	21	397	589	8,585
1980	1	706	2,934	17	1,294	2,310	32	531	599	8,424
1981		523	2,959	44	1,595	2,990	9	1,054	682	9,856
1982		545	3,203	25	1,473	1,746	2	1,042	668	8,704
1983		672	2,583	49	1,103	2,536	13	536	302	7,794
1984		540	2,919	32	904	2,217	6	673	478	7,769
1985		387	3,583	41	861	1,493	17	74	271	6,727
1986		875	2,987	67	893	1,895	14	273	172	7,176
1987	5	735	2,162	301	911	1,817		232	113	6,276
1988	9	536	2,832	359	687	1,334	1	127	58	5,943
1989	32	579	1,401	89	603	1,219	1	45	15	3,984
1990	4	696	1,786	165	755	1,005	4	75	81	4,571
1991	16	553	2,902	287	1,223	1,960	15	56	69	7,081
1992		655	2,676	193	1,043	1,475	17	73	127	6,259
1993		556	1,332	148	729	1,822	10	76	53	4,726
1994		354	1,514	142	688	1,456	7	92	139	4,392
1995		310	1,045	90	511	1,084	2	20	11	3,073
1996		436	773	99	377	1,141	20	72	27	2,945
1997		676	486	50	376	596	1	2	1	2,188
1998		435	361	44	282	758	5	4	7	1,896
1999		300	581	44	206	361		13		1,505
2000		161	461	65	287	232		1		1,207
2001		149	734	45	297	479	1	24		1,729
2002		330	1,668	4	714	419		25	13	3,173
2003		407	1,730	64	839	1,033	21	253	58	4,405
2004		353	1,562	116	865	862	21	203	249	4,231
2005		515	1,553	149	989	880	1	130	50	4,266
2006		493	1,653	135	1,096	632	0	36	17	4,062
2007		501	1,785	118	1,054	714	1	10	13	4,196
2008		239	977	127	551	351	3	44	60	2,351
2009		326	1,641	90	839	693	1	110	16	3,717
2010		458	1,950	281	1,220	703	9	188	46	4,855

Table 2. Commercial landings (metric tons; mt) of scup by major gear types. Midwater paired trawl landings are combined with other gears during 1994 and later. Landings include revised Massachusetts landings for 1986-1997.

Year	Otter trawl	Paired trawl	Floating trap	Pound net	Pots and traps	Hand lines	Other gear	Total mt
1979	6,387	146	1,305	429	26	215	77	8,585
1980	6,192	160	1,559	194	8	303	8	8,424
1981	7,836	79	1,291	246	49	306	49	9,856
1982	6,563	104	1,514	244	9	226	44	8,704
1983	5,861	398	850	390	8	265	22	7,794
1984	5,617	272	1,266	295	8	287	24	7,769
1985	4,856	417	1,022	229	5	182	16	6,727
1986	5,163	540	629	332	9	493	10	7,176
1987	4,607	237	590	193	213	423	13	6,276
1988	4,142	166	1,052	53	44	396	90	5,943
1989	3,174	89	193	74	104	334	16	3,984
1990	3,205	200	505	60	239	340	22	4,571
1991	5,217	152	988	40	258	395	31	7,081
1992	4,371	94	934	67	303	450	40	6,259
1993	3,865	46	166	25	202	402	20	4,726
1994	3,416		331	79	76	340	150	4,392
1995	2,204		331	42	57	215	224	3,073
1996	2,196		229	8	120	374	18	2,945
1997	1,491		86	12	104	489	6	2,188
1998	1,379		11	4	98	390	14	1,896
1999	1,005		140	30	77	184	69	1,505
2000	773		56		78	205	95	1,207
2001	1,088		229	65	52	215	80	1,729
2002	2,084		220		221	450	198	3,173
2003	2,777		723		168	445	292	4,405
2004	3,767		20		121	196	127	4,231
2005	3,475		117		174	448	52	4,266
2006	3,422		106		201	291	42	4,062
2007	3,332		181		279	373	31	4,196
2008	1,966		103		99	171	12	2,351
2009	3,182		110		191	222	12	3,717
2010	4,351		82		182	224	16	4,855

Table 3. Summary NEFSC Fishery Observer Program data for scup. Geometric mean discards to landings ratios (GMDL; retransformed, mean ln-transformed discards to landings ratios [D/L], per trip) are stratified by half-year period (HY1, HY2) and trip landings level (< 300 kg, => 300 kg). N is number of observed trips with both scup landings and discard, which are used to calculate the ratios. Corresponding dealer landings are from the NEFSC database.

1997		Trips <300 kg				Trips =>300 kg		
Period	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)
HY 1	0.8957	17	258	231	0.8221	4	1,244	1,023
HY 2	0.8957	0	279	250	0.8221	0	413	340
Total			537	481			1,657	1,362

1998		Trips <300 kg				Trips =>300 kg		
Period	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)
HY 1	2.401	7	196	471	121.71	1	920	111,973
HY 2	3.126	10	281	878	121.71	0	496	60,368
Total			477	1,349			1,416	172,341

1999		Trips <300 kg				Trips =>300 kg		
Period	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)
HY 1	1.742	6	245	427	3.766	2	785	2,956
HY 2	1.742	0	178	310	3.766	0	299	1,126
Total			423	737			1,084	4,082

Table 3, continued.

2000		Trips <300 kg				Trips =>300 kg		
Period	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)
HY 1	4.5818	13	196	898	0.6018	2	655	394
HY 2	3.5001	1	292	1,022	0.6018	0	63	38
Total		14	488	1,920		2	718	432

2001		Trips <300 kg				Trips =>300 kg		
Period	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)
HY 1	0.8916	10	180	160	0.9185	4	1,013	930
HY 2	0.4606	2	307	141	0.9185	0	290	266
Total		14	487	302		4	1,303	1,197

2002		Trips <300 kg				Trips =>300 kg		
Period	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)
HY 1	2.6088	11	423	1,104	0.0653	2	1,484	97
HY 2	3.4522	12	829	2,862	3.6028	3	437	1,574
Total		23	1,252	3,965		5	1,921	1,671

Table 3, continued.

2003		Trips <300 kg				Trips =>300 kg		
Period	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)
HY 1	0.1371	9	315	43	0.2560	2	2,473	633
HY 2	1.4299	4	921	1,317	0.2304	5	696	160
Total		13	1,236	1,360		7	3,169	793

2004		Trips <300 kg				Trips =>300 kg		
Period	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)
HY 1	0.3370	40	344	116	0.1685	25	2,353	396
HY 2	0.4200	64	868	365	0.0309	10	550	17
Total		104	1,212	480		35	2,903	413

2005		Trips <300 kg				Trips =>300 kg		
Period	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)
HY 1	0.7354	31	292	215	0.0732	7	2,390	175
HY 2	0.2740	67	850	233	0.0563	2	694	39
Total		98	1,142	448		9	3,084	214

Table 3, continued.

2006		Trips <300 kg				Trips =>300 kg		
Period	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)
HY 1	0.6621	37	472	313	0.0740	10	1,814	134
HY 2	0.8573	40	814	698	0.2631	10	921	242
Total		77	1,286	1,010		20	2,735	377

2007		Trips <300 kg				Trips =>300 kg		
Period	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)
HY 1	0.4821	41	461	222	0.2628	10	2,177	572
HY 2	0.9404	54	892	839	0.3389	7	666	226
Total		95	1,353	1,061		17	2,843	798

2008		Trips <300 kg				Trips =>300 kg		
Period	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)
HY 1	0.8719	40	422	368	0.2350	16	1,218	286
HY 2	5.2030	12	401	2,086	0.4596	6	303	139
Total		52	823	2,454		22	1,521	425

Table 3, continued.

2009		Trips <300 kg				Trips =>300 kg		
Period	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)
HY 1	1.1582	83	497	576	0.1810	22	2,043	370
HY 2	0.8504	95	714	607	0.2638	34	463	122
Total		158	1,211	1,183		22	2,506	492

2010		Trips <300 kg				Trips =>300 kg		
Period	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)	GM D/L	N	Dealer Landings (mt)	Estimated Discard (mt)
HY 1	1.4322	131	617	884	0.1478	30	2,324	343
HY 2	0.7309	83	1,041	761	0.1379	27	873	120
Total		214	1,658	1,645		57	3,197	463

Table 4. Summary of landings, discards, and the aggregate geometric mean discards to landings ratio (GMDL). Catches in metric tons (mt).

Year	Landings (mt)	Discards (mt)	GMDL ratio	GMDL Discards PSE (%)
1997	2,194	1,843	0.84	61
1998	1,893	173,690	91.75	32
1999	1,507	4,819	3.20	9
2000	1,206	2,352	1.95	48
2001	1,790	1,499	0.84	32
2002	3,173	5,636	1.78	95
2003	4,405	2,153	0.49	41
2004	4,227	893	0.21	25
2005	4,226	662	0.16	29
2006	4,021	1,387	0.34	27
2007	4,196	1,859	0.44	26
2008	2,351	2,879	1.23	31
2009	3,717	1,675	0.45	22
2010	4,855	2,108	0.43	31

Table 5. Total catch (metric tons) of scup from Maine through North Carolina. Landings include revised Massachusetts landings for 1986-1997. Commercial discards for 1984-1988 calculated as the geometric mean ratio of discards to landings numbers at age for 1989-1993. Commercial discards estimate for 1998 is the mean of 1997 and 1999 estimates.

Year	Commercial Landings	Commercial Discards	Recreational Landings	Recreational Discards	Total Catch
1981	9,856	n/a	2,636	n/a	12,492
1982	8,704	n/a	2,361	n/a	11,065
1983	7,794	n/a	2,836	n/a	10,630
1984	7,769	2,158	1,096	30	11,053
1985	6,727	4,184	2,764	54	13,729
1986	7,176	2,005	5,264	87	14,532
1987	6,276	2,537	2,811	38	11,662
1988	5,943	1,657	1,936	31	9,567
1989	3,984	2,229	2,521	39	8,773
1990	4,571	3,909	1,878	38	10,396
1991	7,081	3,530	3,668	78	14,357
1992	6,259	5,668	2,001	47	13,975
1993	4,726	1,436	1,450	28	7,640
1994	4,392	807	1,192	37	6,428
1995	3,073	2,057	609	13	5,752
1996	2,945	1,522	978	20	5,465
1997	2,188	1,843	543	8	4,582
1998	1,896	3,331	397	14	5,638
1999	1,505	4,819	856	6	7,186
2000	1,207	2,352	2,469	55	6,083
2001	1,729	1,499	1,933	165	5,326
2002	3,173	5,636	1,644	137	10,590
2003	4,405	2,153	3,848	158	10,564
2004	4,231	893	1,923	134	7,181
2005	4,266	662	1,153	227	6,308
2006	4,062	1,387	1,331	393	7,173
2007	4,196	1,859	1,655	316	8,026
2008	2,351	2,879	1,834	296	7,360
2009	3,717	1,675	1,334	191	6,917
2010	4,855	2,108	2,605	309	9,877

Table 6. Summary of the landed fish length sampling for scup in the NER (ME-VA) commercial fishery.

Year	No. of samples	No. of lengths	NER Landings (mt)	Sampling rate (mt/100 lengths)
1979	10	1,250	8,585	687
1980	26	3,478	8,424	242
1981	16	2,005	9,856	492
1982	81	9,896	8,704	88
1983	72	7,860	7,794	99
1984	60	6,303	7,769	123
1985	31	3,058	6,727	220
1986	54	5,467	7,176	131
1987	61	6,491	6,276	97
1988	85	8,691	5,943	68
1989	46	4,806	3,984	83
1990	46	4,736	4,571	97
1991	31	3,150	7,081	225
1992	33	3,260	6,259	192
1993	23	2,287	4,726	207
1994	22	2,163	4,392	203
1995	22	2,487	3,073	124
1996	61	6,544	2,945	45
1997	37	3,732	2,188	59
1998	41	4,022	1,896	47
1999	56	6,040	1,505	25
2000	22	2,352	1,207	51
2001	40	3,934	1,729	44
2002	26	2,587	3,173	123
2003	78	6,681	4,405	66
2004	144	13,172	4,231	32
2005	124	9,324	4,266	46
2006	152	12,506	4,062	32
2007	198	15,704	4,196	27
2008	154	12,764	2,351	18
2009	112	9,694	3,717	38
2010	105	9,860	4,855	49

Table 7. Commercial fishery scup landings (000s) at age.

Year	0	1	2	3	4	5	6	7	8	9	10	Total
1984	1	2691	6114	7090	5793	1418	536	251	1	0	0	23895
1985	79	3245	6767	7696	2640	346	520	159	0	0	0	21452
1986	9	301	12321	4773	1004	75	106	337	5	0	0	18931
1987	2	1679	9952	10399	1725	177	124	21	18	0	1	24098
1988	17	423	7709	9526	2424	58	127	39	0	0	0	20323
1989	17	1484	4943	7071	685	22	69	24	0	0	0	14315
1990	0	247	10203	6781	1022	355	149	2	0	0	0	18759
1991	0	2412	12956	10202	2161	409	193	0	0	0	0	28334
1992	21	1577	10883	3737	3797	1243	138	0	0	0	0	21396
1993	1	230	6558	6877	1500	1143	124	0	0	0	0	16433
1994	0	1052	13544	6358	836	82	39	0	0	0	0	21911
1995	0	2198	8345	2878	891	248	31	0	0	0	0	14591
1996	0	346	6343	1640	770	469	62	0	0	0	0	9630
1997	0	131	2080	4089	732	84	97	0	0	0	0	7213
1998	0	340	1453	2373	1092	381	2	0	0	0	0	5641
1999	0	1	1148	2688	527	117	0	0	0	0	0	4481
2000	0	0	661	2144	511	15	0	0	0	0	0	3331
2001	0	31	1635	3033	695	46	6	1	1	0	0	5448
2002	0	124	1219	5051	2132	393	5	0	0	0	0	8922
2003	0	2	955	2974	4553	1131	121	41	5	14	0	9796
2004	0	1	844	2406	2826	2089	296	40	4	14	0	8520
2005	0	31	683	1558	2361	2515	807	92	3	3	0	8053
2006	0	89	2233	2231	1119	1477	1219	366	28	3	0	8765
2007	0	91	2787	2661	1390	680	940	590	124	12	0	9275
2008	0	36	1304	2411	1108	306	254	257	34	1	1	5712
2009	0	3	1305	4277	2592	818	220	206	125	10	0	9556
2010	0	34	1717	3788	3863	1791	259	146	97	16	1	11712

Table 8. Commercial fishery scup landings mean weights (kg) at age.

Year	0	1	2	3	4	5	6	7	8	9	10	Total
1984	0.033	0.155	0.190	0.293	0.344	0.398	0.767	1.044	1.545	0	0	0.288
1985	0.043	0.134	0.197	0.293	0.409	0.517	0.739	1.042	0	0	0	0.272
1986	0.036	0.140	0.219	0.357	0.676	0.670	1.010	1.246	1.616	0	0	0.302
1987	0.034	0.136	0.203	0.244	0.407	0.544	0.747	1.194	1.068	0	0	0.237
1988	0.044	0.123	0.201	0.263	0.441	0.636	0.715	0.982	0	0	0	0.263
1989	0.025	0.144	0.188	0.275	0.367	0.651	0.721	1.036	0	0	0	0.240
1990	0	0.140	0.189	0.246	0.367	0.518	0.842	0.846	0	1.096	0	0.230
1991	0	0.187	0.194	0.263	0.389	0.511	0.729	0	0	0	0	0.241
1992	0.039	0.173	0.199	0.325	0.419	0.503	0.859	0	0	1.096	0	0.280
1993	0.031	0.140	0.197	0.261	0.442	0.510	0.782	0	0	0	0	0.272
1994	0	0.203	0.193	0.259	0.430	0.663	0.742	0	0	0	0	0.224
1995	0	0.161	0.209	0.295	0.396	0.480	0.724	0	0	0	0	0.236
1996	0	0.206	0.200	0.325	0.468	0.554	0.784	0	0	0	0	0.264
1997	0	0.227	0.253	0.300	0.386	0.529	0.749	0	0	0	0	0.303
1998	0	0.200	0.254	0.313	0.459	0.556	0.748	0	0	0	0	0.336
1999	0	0.075	0.220	0.323	0.497	0.748	0	0	0	0	0	0.328
2000	0	0	0.221	0.367	0.504	0.674	0	0	0	0	0	0.360
2001	0	0.229	0.265	0.346	0.476	0.562	0.779	1.003	1.003	0	0	0.340
2002	0	0.231	0.281	0.339	0.465	0.577	0.748	0	0	0	0	0.370
2003	0	0.187	0.285	0.362	0.471	0.659	0.859	0.884	1.241	0	0	0.448
2004	0	0.182	0.313	0.398	0.518	0.591	0.812	1.002	1.370	1.674	0	0.496
2005	0	0.196	0.269	0.362	0.471	0.652	0.809	1.044	1.099	1.311	0	0.529
2006	0	0.213	0.283	0.344	0.460	0.591	0.727	0.915	1.108	1.314	0	0.463
2007	0	0.217	0.265	0.353	0.470	0.646	0.768	0.894	1.077	1.697	0	0.452
2008	0	0.197	0.264	0.321	0.486	0.634	0.804	0.973	1.176	1.435	2.437	0.412
2009	0	0.177	0.252	0.290	0.439	0.590	0.821	0.958	1.086	1.360	1.815	0.389
2010	0	0.191	0.251	0.313	0.426	0.548	0.784	0.941	1.054	1.232	1.510	0.403

Table 9. Summary of length sampling for scup in the NEFSC Fishery Observer Program. OT =number of otter trawl trips sampled with scup discard lengths. H1 = first half year; H2 = second half year. Discards in metric tons (mt).

Year	OT trips	Lengths H1	Lengths H2	Lengths Total	Discards	Sampling Intensity (mt/100 lengths)
1989	61	4,449	2,910	7,359	2,229	30
1990	52	2,582	781	3,363	3,909	116
1991	91	1,237	1,780	3,017	3,530	117
1992	53	1,158	0	1,158	5,668	489
1993	29	275	154	429	1,436	335
1994	7	99	119	218	807	370
1995	18	162	383	556	2,057	370
1996	27	1,093	435	1,528	1,522	100
1997	45	750	1	751	1,843	245
1998	33	618	64	682	3,331	488
1999	35	586	89	675	4,819	714
2000	62	3,981	762	4,743	2,352	50
2001	67	1,231	229	1,460	1,499	103
2002	65	1,422	866	2,288	5,636	246
2003	72	925	284	1,209	2,153	178
2004	80	1,948	1,051	2,999	893	30
2005	73	797	1,159	1,956	662	34
2006	47	1,486	777	2,263	1,387	61
2007	59	1,313	1,058	2,371	1,859	78
2008	54	1,217	1,259	2,476	2,879	116
2009	111	3,498	2,788	6,286	1,675	27
2010	137	5,185	2,466	7,651	2,108	28

Table 10. Commercial fishery scup discards (000s) at age.

Year	0	1	2	3	4	5	6	7	8	9	10	Total
1984	78	10847	6367	924	21	0	0	0	0	0	0	18237
1985	52773	13093	6534	1060	10	0	0	0	0	0	0	73470
1986	78	1180	14040	602	3	0	0	0	0	0	0	15903
1987	78	6814	12215	1366	5	0	0	0	0	0	0	20478
1988	1552	1698	9242	1339	10	0	0	0	0	0	0	13841
1989	387	8943	13603	813	28	0	0	0	0	0	0	23774
1990	822	8269	17249	2801	0	0	0	0	0	0	0	29141
1991	1794	17231	5397	1733	5	0	0	0	0	0	0	26160
1992	38804	10023	26380	72	0	0	0	0	0	0	0	75279
1993	5386	1549	6960	224	0	0	0	0	0	0	0	14119
1994	6858	3099	3422	74	0	0	0	0	0	0	0	13453
1995	1855	50174	335	108	14	0	0	0	0	0	0	52486
1996	199	3009	5990	691	21	1	0	0	0	0	0	9911
1997	1	618	8250	1871	0	0	0	0	0	0	0	10740
1998	18	17524	11849	1127	247	57	0	0	0	0	0	30822
1999	1338	2563	18123	3139	691	201	0	0	0	0	0	26055
2000	853	11206	4890	1475	55	57	0	0	0	0	0	18536
2001	3536	4232	2647	355	281	207	57	0	0	0	0	11315
2002	9561	22393	5834	4431	518	571	75	0	0	0	0	43383
2003	1480	1578	3779	937	752	503	93	0	0	0	0	9122
2004	545	1397	1423	1176	220	187	8	0	0	0	0	4956
2005	460	893	1879	516	79	47	15	0	0	0	0	3889
2006	4809	8083	2354	642	53	13	16	0	0	0	0	15970
2007	1412	3936	5370	1420	94	41	87	0	0	0	0	12360
2008	1061	7526	2937	821	215	86	81	128	86	0	0	12941
2009	643	3237	3473	1558	577	134	44	44	29	0	0	9739
2010	398	1345	6155	2314	910	232	38	22	20	5	1	11440

Table 11. Commercial fishery scup discards mean weights (kg) at age.

Year	0	1	2	3	4	5	6	7	8	9	10	Total
1984	0.033	0.108	0.125	0.198	0.222	0	0	0	0	0	0	0.118
1985	0.033	0.108	0.125	0.198	0.222	0	0	0	0	0	0	0.057
1986	0.033	0.108	0.125	0.198	0.222	0	0	0	0	0	0	0.126
1987	0.033	0.108	0.125	0.198	0.222	0	0	0	0	0	0	0.124
1988	0.033	0.108	0.125	0.198	0.222	0	0	0	0	0	0	0.120
1989	0.039	0.060	0.111	0.198	0.217	0	0	0	0	0	0	0.094
1990	0.026	0.121	0.137	0.187	0	0	0	0	0	0	0	0.134
1991	0.057	0.127	0.163	0.207	0.252	0	0	0	0	0	0	0.135
1992	0.033	0.078	0.136	0.243	0	0	0	0	0	0	0	0.075
1993	0.026	0.106	0.154	0.269	0	0	0	0	0	0	0	0.102
1994	0.024	0.068	0.122	0.198	0	0	0	0	0	0	0	0.060
1995	0.038	0.037	0.229	0.310	0.331	0	0	0	0	0	0	0.039
1996	0.033	0.110	0.169	0.240	0.268	0.532	0	0	0	0	0	0.154
1997	0.020	0.028	0.137	0.362	0.000	0.000	0	0	0	0	0	0.170
1998	0.092	0.069	0.147	0.224	0.418	0.564	0	0	0	0	0	0.108
1999	0.010	0.037	0.158	0.398	0.599	0.690	0	0	0	0	0	0.183
2000	0.044	0.076	0.195	0.299	0.486	0.768	0	0	0	0	0	0.127
2001	0.015	0.063	0.168	0.345	0.500	0.670	0.944	0	0	0	0	0.108
2002	0.035	0.064	0.201	0.361	0.524	0.757	1.071	0	0	0	0	0.123
2003	0.022	0.091	0.212	0.315	0.537	0.784	0.878	0	0	0	0	0.236
2004	0.029	0.109	0.166	0.268	0.371	0.453	0.750	0	0	0	0	0.180
2005	0.019	0.090	0.154	0.267	0.416	0.652	0.912	0	0	0	0	0.153
2006	0.026	0.086	0.166	0.217	0.313	0.549	0.755	0	0	0	0	0.087
2007	0.041	0.094	0.163	0.282	0.342	0.597	0.770	0	0	0	0	0.148
2008	0.039	0.096	0.182	0.294	0.495	0.742	0.884	1.078	1.442	0	0	0.158
2009	0.032	0.083	0.160	0.261	0.401	0.582	0.810	0.962	1.154	0	0	0.172
2010	0.027	0.096	0.147	0.240	0.340	0.516	0.780	0.967	1.144	1.302	1.503	0.185

Table 12. Summary of the landed fish length sampling for scup in the recreational fishery (includes MRFSS and state agency sampling). Landings in metric tons (mt).

Year	No. of lengths	Estimated landings (A + B1; mt)	Sampling intensity (mt/100 lengths)
1981	642	2,636	411
1982	1,057	2,361	223
1983	1,384	2,836	205
1984	943	1,096	116
1985	741	2,764	373
1986	2,580	5,264	204
1987	777	2,811	362
1988	2,156	1,936	90
1989	4,111	2,521	61
1990	2,698	1,878	70
1991	4,230	3,668	87
1992	4,419	2,001	45
1993	2,206	1,450	66
1994	1,374	1,192	87
1995	822	609	74
1996	526	978	186
1997	399	543	136
1998	286	397	139
1999	265	856	323
2000	524	2,469	471
2001	1,038	1,933	186
2002	1,006	1,644	163
2003	2,508	3,848	153
2004	1,802	1,923	107
2005	1,794	1,153	64
2006	2,217	1,331	60
2007	2,262	1,655	73
2008	2,426	1,834	76
2009	2,269	1,334	59
2010	2,710	2,605	96

Table 13. Recreational fishery scup landings (000s) at age.

Year	0	1	2	3	4	5	6	7	8	9	10	Total
1984	23	3036	1353	570	182	219	442	86	51	30	66	6058
1985	431	4478	3054	1330	788	441	137	33	0	0	115	10807
1986	538	4353	15570	2617	845	431	87	5	4	57	315	24822
1987	77	2299	4686	1261	824	598	112	0	0	11	46	9914
1988	9	1001	2229	1824	460	216	123	92	20	0	86	6060
1989	311	3978	3371	823	86	235	154	13	0	50	148	9169
1990	169	1352	5091	1102	147	112	36	7	2	3	22	8043
1991	299	4838	3797	3319	700	210	19	0	2	20	68	13272
1992	99	1850	4457	530	672	84	12	6	8	7	30	7755
1993	46	1245	3051	908	254	133	2	2	0	2	7	5650
1994	31	1473	1840	691	95	88	21	6	0	0	0	4245
1995	15	613	1399	225	89	20	3	3	0	0	0	2367
1996	9	351	1467	812	365	54	10	15	0	0	0	3083
1997	32	52	983	562	168	63	33	17	6	0	0	1916
1998	13	223	257	415	248	19	13	23	0	0	0	1211
1999	61	469	2169	359	182	11	0	0	0	0	0	3251
2000	6	912	3443	2113	641	129	0	0	0	0	0	7244
2001	0.3	514	1511	1705	806	244	101	218	0	0	0	5099
2002	7	70	688	1635	1005	179	24	39	0	0	0	3647
2003	0.3	75	1723	2655	3127	1407	350	115	0	0	0	9452
2004	0.9	45	284	1551	1441	1166	470	32	0	0	0	4990
2005	0	13	100	513	700	845	349	26	0	0	0	2546
2006	1	50	658	819	404	431	541	46	0	1	0	2951
2007	3	47	456	1347	775	378	605	206	26	1	0	3844
2008	2	52	732	1352	842	205	338	133	17	1	0	3674
2009	1	37	159	1007	1003	365	109	64	24	2	0	2771
2010	2	11	300	1293	1660	842	232	446	171	8	1	4966

Table 14. Recreational fishery scup landings mean weights (kg) at age.

Year	0	1	2	3	4	5	6	7	8	9	10	Total
1984	0.044	0.117	0.266	0.373	0.472	0.557	0.678	0.825	0.912	1.002	1.145	0.274
1985	0.038	0.125	0.253	0.340	0.573	0.718	0.913	1.087	0	0	1.673	0.270
1986	0.052	0.101	0.234	0.374	0.534	0.654	0.801	0.912	1.003	1.003	1.638	0.261
1987	0.029	0.105	0.242	0.381	0.548	0.698	0.737	0.000	0.000	1.003	3.808	0.302
1988	0.026	0.142	0.240	0.325	0.497	0.663	0.794	1.144	1.099	0	1.532	0.330
1989	0.035	0.123	0.234	0.376	0.433	0.653	0.696	0.657	0.000	1.003	1.332	0.235
1990	0.057	0.128	0.208	0.325	0.461	0.567	0.761	0.939	1.088	1.202	1.947	0.225
1991	0.064	0.150	0.275	0.361	0.474	0.714	0.675	0	1.003	1.003	1.305	0.271
1992	0.092	0.140	0.240	0.373	0.454	0.598	0.804	0.859	1.311	1.003	2.117	0.256
1993	0.087	0.135	0.226	0.336	0.460	0.524	0.912	0.827	0	1.026	1.100	0.242
1994	0.054	0.180	0.281	0.357	0.467	0.674	0.905	1.430	0	0	0	0.274
1995	0.065	0.155	0.279	0.450	0.557	0.756	1.044	1.311	0	0	0	0.279
1996	0.093	0.171	0.231	0.368	0.540	0.772	0.876	1.383	0	0	0	0.314
1997	0.083	0.110	0.253	0.299	0.510	0.684	0.819	1.342	0.779	0	0	0.318
1998	0.072	0.121	0.211	0.312	0.491	0.866	1.066	1.950	0	0	0	0.337
1999	0.095	0.173	0.274	0.451	0.635	0.900	0	0	0	0	0	0.298
2000	0.075	0.138	0.296	0.424	0.544	0.825	0	0	0	0	0	0.345
2001	0.092	0.220	0.344	0.485	0.637	0.776	0.875	1.127	0	0	0	0.490
2002	0.110	0.152	0.296	0.427	0.618	0.795	0.932	1.427	0	0	0	0.481
2003	0.092	0.161	0.314	0.416	0.536	0.720	0.908	1.499	0	0	0	0.512
2004	0.094	0.151	0.325	0.437	0.523	0.575	0.858	0.748	0	0	0	0.527
2005	0	0.112	0.270	0.384	0.516	0.679	0.881	1.098	0	0	0	0.588
2006	0.092	0.151	0.304	0.411	0.525	0.695	0.883	0.999	0	1.311	0	0.536
2007	0.111	0.152	0.313	0.418	0.509	0.672	0.882	0.935	1.056	1.322	0	0.551
2008	0.080	0.162	0.318	0.442	0.545	0.714	0.996	1.035	1.201	1.350	0	0.528
2009	0.064	0.127	0.279	0.419	0.539	0.666	0.918	1.035	1.085	1.409	0	0.523
2010	0.028	0.129	0.282	0.408	0.522	0.668	0.897	1.373	1.202	1.307	1.482	0.620

Table 15. Recreational fishery scup discards (000s) at age.

Year	0	1	2	3	4	5	6	7	8	9	10	Total	Metric tons
1984	2	255	0	0	0	0	0	0	0	0	0	257	30
1985	40	417	0	0	0	0	0	0	0	0	0	457	54
1986	100	807	0	0	0	0	0	0	0	0	0	907	87
1987	12	357	0	0	0	0	0	0	0	0	0	369	38
1988	2	219	0	0	0	0	0	0	0	0	0	221	31
1989	24	308	0	0	0	0	0	0	0	0	0	332	39
1990	36	284	0	0	0	0	0	0	0	0	0	320	38
1991	31	505	0	0	0	0	0	0	0	0	0	536	78
1992	17	325	0	0	0	0	0	0	0	0	0	342	47
1993	8	204	0	0	0	0	0	0	0	0	0	212	28
1994	4	203	0	0	0	0	0	0	0	0	0	207	37
1995	63	135	0	0	0	0	0	0	0	0	0	198	13
1996	44	222	0	0	0	0	0	0	0	0	0	266	20
1997	163	10	0	0	0	0	0	0	0	0	0	173	8
1998	80	139	0	0	0	0	0	0	0	0	0	219	14
1999	208	0	0	0	0	0	0	0	0	0	0	208	6
2000	20	561	25	0	0	0	0	0	0	0	0	606	55
2001	0.3	484	325	0	0	0	0	0	0	0	0	809	165
2002	14	199	381	55	0	0	0	0	0	0	0	649	137
2003	1	168	550	63	0	0	0	0	0	0	0	782	158
2004	7	232	242	211	0	0	0	0	0	0	0	692	134
2005	5	88	232	135	44	46	11	1	0	0	0	562	165
2006	1	143	644	66	0	0	0	0	0	0	0	854	185
2007	20	185	375	124	20	2	1	0	0	0	0	727	157
2008	24	230	511	282	50	9	5	8	1	0	0	1120	296
2009	11	137	307	247	46	6	1	1	1	0	0	757	191
2010	6	75	289	276	150	41	15	9	7	4	0	872	309

Table 16. Recreational fishery scup discards mean weights (kg) at age.

Year	0	1	2	3	4	5	6	7	8	9	10	Total
1984	0.044	0.117	0	0	0	0	0	0	0	0	0	0.116
1985	0.038	0.125	0	0	0	0	0	0	0	0	0	0.117
1986	0.052	0.101	0	0	0	0	0	0	0	0	0	0.096
1987	0.029	0.105	0	0	0	0	0	0	0	0	0	0.103
1988	0.026	0.142	0	0	0	0	0	0	0	0	0	0.141
1989	0.035	0.123	0	0	0	0	0	0	0	0	0	0.117
1990	0.057	0.128	0	0	0	0	0	0	0	0	0	0.120
1991	0.064	0.150	0	0	0	0	0	0	0	0	0	0.145
1992	0.092	0.140	0	0	0	0	0	0	0	0	0	0.138
1993	0.087	0.135	0	0	0	0	0	0	0	0	0	0.133
1994	0.054	0.180	0	0	0	0	0	0	0	0	0	0.178
1995	0.063	0.065	0	0	0	0	0	0	0	0	0	0.064
1996	0.075	0.075	0	0	0	0	0	0	0	0	0	0.075
1997	0.043	0.075	0	0	0	0	0	0	0	0	0	0.045
1998	0.061	0.068	0	0	0	0	0	0	0	0	0	0.065
1999	0.028	0.000	0	0	0	0	0	0	0	0	0	0.028
2000	0.075	0.087	0.189	0	0	0	0	0	0	0	0	0.091
2001	0.092	0.194	0.218	0	0	0	0	0	0	0	0	0.204
2002	0.110	0.155	0.238	0.250	0	0	0	0	0	0	0	0.211
2003	0.092	0.141	0.215	0.251	0	0	0	0	0	0	0	0.202
2004	0.094	0.149	0.206	0.233	0	0	0	0	0	0	0	0.194
2005	0.035	0.114	0.215	0.311	0.481	0.698	0.810	1.110	0	0	0	0.294
2006	0.092	0.148	0.229	0.243	0	0	0	0	0	0	0	0.216
2007	0.067	0.127	0.220	0.322	0.408	0.567	0	0	0	0	0	0.215
2008	0.039	0.121	0.242	0.343	0.507	0.781	0.854	1.074	1.233	0	0	0.264
2009	0.048	0.125	0.226	0.313	0.432	0.662	0.937	0.980	1.093	0	0	0.253
2010	0.048	0.132	0.226	0.342	0.470	0.729	0.898	1.092	1.218	1.678	0	0.354

Table 17. Total fishery scup catch (000s) at age.

Year	0	1	2	3	4	5	6	7	8	9	10	Total	7+
1984	104	16829	13834	8584	5996	1637	978	337	52	30	66	48447	485
1985	53323	21233	16355	10086	3438	787	657	192	0	0	115	106186	307
1986	725	6641	41931	7992	1852	506	193	342	9	57	315	60563	723
1987	169	11149	26853	13026	2554	775	236	21	18	11	47	54859	97
1988	1580	3341	19180	12689	2894	274	250	131	20	0	86	40445	237
1989	739	14713	21917	8707	799	257	223	37	0	50	148	47590	235
1990	1027	10152	32543	10684	1169	467	185	9	2	3	22	56263	36
1991	2124	24986	22150	15254	2866	619	212	0	2	20	68	68302	90
1992	38941	13775	41720	4339	4469	1327	150	6	8	7	30	104772	51
1993	5441	3228	16569	8009	1754	1276	126	2	0	2	7	36414	11
1994	6893	5827	18806	7123	931	170	60	6	0	0	0	39816	6
1995	1933	53120	10079	3211	994	268	34	3	0	0	0	69642	3
1996	252	3928	13800	3143	1156	524	72	15	0	0	0	22890	15
1997	196	811	11313	6522	900	147	130	17	6	0	0	20042	23
1998	111	18226	13559	3915	1587	457	15	23	0	0	0	37893	23
1999	1607	3033	21440	6186	1400	329	0	0	0	0	0	33995	0
2000	879	12679	9019	5732	1207	201	0	0	0	0	0	29717	0
2001	3537	5261	6118	5093	1782	497	164	219	1	0	0	22671	220
2002	9582	22786	8122	11172	3655	1143	104	39	0	0	0	56601	39
2003	1481	1823	7007	6629	8432	3041	564	156	5	14	0	29152	175
2004	553	1675	2793	5344	4487	3442	774	72	4	14	0	19158	90
2005	465	1025	2894	2722	3184	3453	1182	119	3	3	0	15050	125
2006	4811	8365	5889	3758	1576	1921	1776	412	28	4	0	28540	444
2007	1435	4259	8988	5552	2279	1101	1633	796	150	13	0	26206	959
2008	1087	7844	5484	4866	2215	606	678	526	138	2	1	23447	667
2009	655	3414	5244	7089	4218	1323	374	315	179	12	0	22823	506
2010	406	1465	8461	7671	6583	2906	544	623	295	33	3	28990	954

Table 18. Total fishery scup catch mean weights (kg) at age.

Year	0	1	2	3	4	5	6	7	8	9	10	Total	7+
1984	0.036	0.117	0.168	0.288	0.348	0.419	0.727	0.988	0.924	1.002	1.145	0.222	1.003
1985	0.033	0.116	0.179	0.289	0.446	0.629	0.775	1.050	0	0	1.673	0.122	1.283
1986	0.050	0.104	0.193	0.351	0.611	0.656	0.916	1.241	1.344	1.003	1.638	0.236	1.397
1987	0.031	0.112	0.174	0.253	0.452	0.663	0.742	1.194	1.068	1.003	3.727	0.206	2.376
1988	0.033	0.122	0.169	0.265	0.449	0.657	0.754	1.096	1.099	0	1.532	0.223	1.254
1989	0.037	0.087	0.147	0.277	0.369	0.653	0.704	0.903	0	1.003	1.332	0.165	1.194
1990	0.032	0.123	0.164	0.239	0.379	0.530	0.826	0.918	1.088	1.195	1.947	0.179	1.577
1991	0.058	0.138	0.201	0.278	0.409	0.580	0.724	0.000	1.003	1.003	1.305	0.206	1.231
1992	0.033	0.099	0.164	0.329	0.424	0.509	0.854	0.859	1.311	1.004	2.117	0.131	1.689
1993	0.027	0.121	0.184	0.270	0.445	0.512	0.784	0.827	0	1.026	1.100	0.200	1.037
1994	0.024	0.125	0.189	0.267	0.434	0.669	0.799	1.430	0	0	0	0.174	1.430
1995	0.039	0.044	0.219	0.306	0.409	0.501	0.752	1.311	0	0	0	0.088	1.311
1996	0.042	0.122	0.190	0.317	0.487	0.577	0.796	1.327	0	0	0	0.221	1.327
1997	0.049	0.066	0.168	0.318	0.409	0.595	0.767	1.342	0.779	0	0	0.231	1.195
1998	0.067	0.072	0.160	0.287	0.458	0.570	1.024	1.950	0	0	0	0.149	1.950
1999	0.016	0.058	0.173	0.368	0.565	0.718	0.947	1.538	0	0	0	0.212	1.538
2000	0.045	0.081	0.235	0.371	0.524	0.798	0.947	1.538	0	0	0	0.205	1.538
2001	0.015	0.091	0.240	0.392	0.553	0.712	0.896	1.126	0	0	0	0.253	1.123
2002	0.035	0.066	0.223	0.360	0.515	0.701	1.024	1.427	0	0	0	0.186	1.427
2003	0.022	0.099	0.247	0.376	0.501	0.708	0.893	1.337	1.241	0	0	0.396	1.228
2004	0.030	0.116	0.230	0.374	0.512	0.578	0.839	0.889	1.370	1.674	0	0.412	1.033
2005	0.019	0.096	0.190	0.346	0.480	0.659	0.832	1.056	1.099	1.311	0	0.433	1.063
2006	0.026	0.089	0.233	0.335	0.472	0.614	0.775	0.924	1.108	1.313	0	0.253	0.939
2007	0.042	0.099	0.205	0.350	0.477	0.653	0.810	0.905	1.073	1.668	0	0.316	0.941
2008	0.039	0.098	0.225	0.351	0.510	0.679	0.910	1.016	1.345	1.393	2.437	0.283	1.087
2009	0.032	0.085	0.190	0.303	0.458	0.610	0.848	0.974	1.097	1.368	0	0.308	1.027
2010	0.027	0.100	0.176	0.308	0.439	0.583	0.835	1.253	1.150	1.315	1.498	0.352	1.224

Table 19. Extended series of total fishery catch. Catches in metric tons (mt). To estimate commercial discards for 1960-1988, D/L ratio for 1989-1997 = 0.504 was applied to commercial landings. To estimate recreational catch for 1960-1980, 50% of the Mayo 1982 estimates were included.

Year	Comm. Land.	Comm. Disc.	DWF Land.	Rec. Catch	Total Catch
1960	22236	11198	0	3765	37,199
1961	20944	10548	0	3716	35,208
1962	20831	10491	0	3667	34,989
1963	18884	9510	5863	3528	37,785
1964	17204	8664	459	3341	29,668
1965	15785	7950	2089	3265	29,089
1966	11960	6023	823	2474	21,280
1967	8748	4406	896	1879	15,929
1968	6630	3339	2251	1473	13,693
1969	5149	2593	485	1107	9,334
1970	4493	2263	288	1003	8,047
1971	3974	2001	889	853	7,717
1972	4203	2117	1647	796	8,763
1973	5024	2530	1783	1118	10,455
1974	7106	3579	958	1,388	13,031
1975	7623	3839	685	1,403	13,550
1976	7302	3677	87	1,183	12,249
1977	8330	4195	28	1,398	13,951
1978	8936	4500	3	1,256	14,695
1979	8585	4324	0	1,198	14,107
1980	8424	4242	16	3,109	15,791
1981	9,856	4964	1	2,636	17,457
1982	8,704	4383	0	2,361	15,448
1983	7,794	3925	0	2,836	14,555
1984	7,769	2158	0	1,126	11,053
1985	6,727	4184	0	2,818	13,729
1986	7,176	2005	0	5,351	14,532
1987	6,276	2537	0	2,849	11,662
1988	5,943	1657	0	1,967	9,567
1989	3,984	2229	0	2,560	8,773
1990	4,571	3909	0	1,916	10,396
1991	7,081	3530	0	3,746	14,357
1992	6,259	5668	0	2,048	13,975
1993	4,726	1436	0	1,478	7,640
1994	4,392	807	0	1,229	6,428
1995	3,073	2,057	0	622	5,752
1996	2,945	1,522	0	998	5,465
1997	2,188	1,843	0	551	4,582
1998	1,896	3,331	0	411	5,638
1999	1,505	4,819	0	862	7,186

Table 19, continued.

Year	Comm. Land.	Comm. Disc.	DWF Land.	Rec. Catch	Total Catch
2000	1,207	2,352	0	2,524	6,083
2001	1,729	1,499	0	2,098	5,326
2002	3,173	5,636	0	1,781	10,590
2003	4,405	2,153	0	4,006	10,564
2004	4,231	893	0	2,057	7,181
2005	4,266	662	0	1,380	6,308
2006	4,062	1,387	0	1,724	7,173
2007	4,196	1,859	0	1,971	8,026
2008	2,351	2,879	0	2,130	7,360
2009	3,717	1,675	0	1,526	6,918
2010	4,855	2,108	0	2,914	9,877

Table 20. NEFSC spring and fall trawl survey indices for scup. Strata sets include only offshore strata 1-12, 23, 25 and 61-76 for consistency over entire time series. The fall strata set excludes inshore strata 1-61 that are included in the 1984 and later indices at age in Tables 23 and 25.

Year	Spring N/tow	Spring Kg/tow	Spring SSB Kg/tow	Spring SSB 3-yr avg	Fall N/tow	Fall Kg/tow
1963					2.12	1.21
1964					118.70	2.23
1965					3.84	0.62
1966					2.00	0.41
1967					29.38	1.46
1968	59.21	2.25	0.94		14.35	0.54
1969	2.26	0.40	0.39	0.88	99.41	4.48
1970	78.50	3.01	1.30	1.09	10.34	0.22
1971	70.91	2.41	1.57	1.28	7.730	0.25
1972	49.80	2.30	0.98	1.21	40.56	2.34
1973	3.62	1.19	1.09	1.38	22.82	0.93
1974	30.28	3.24	2.06	1.92	9.94	1.01
1975	14.01	3.12	2.61	1.73	52.21	3.40
1976	4.09	0.63	0.53	2.50	161.14	7.35
1977	42.46	4.48	4.35	2.49	32.69	1.71
1978	39.85	3.49	2.59	2.77	12.17	1.32
1979	22.42	1.95	1.38	1.69	15.77	0.61
1980	9.31	1.31	1.09	1.12	11.05	0.92
1981	14.72	1.16	0.89	1.00	67.14	3.01
1982	7.88	1.16	1.02	0.65	25.47	1.17
1983	0.80	0.29	0.03	0.46	4.59	0.34
1984	8.52	0.51	0.33	0.24	24.03	1.22
1985	14.67	0.80	0.37	0.68	68.30	3.56
1986	11.74	1.30	1.33	0.98	46.19	1.66
1987	10.82	1.21	1.24	1.10	5.76	0.15
1988	25.41	1.26	0.73	0.66	5.75	0.09
1989	1.63	0.12	0.00	0.35	94.05	3.37
1990	1.17	0.39	0.34	0.26	16.53	0.83
1991	12.61	0.75	0.45	0.32	9.52	0.43
1992	6.79	0.40	0.21	0.32	16.19	1.12
1993	2.93	0.33	0.31	0.18	0.43	0.04
1994	1.54	0.09	0.03	0.15	3.59	0.11
1995	2.90	0.22	0.12	0.06	24.72	0.91
1996	0.53	0.03	0.02	0.08	4.46	0.23
1997	0.91	0.11	0.11	0.06	16.92	0.88
1998	40.04	0.87	0.05	0.08	25.35	0.69
1999	1.70	0.12	0.09	0.08	85.23	2.07
2000	6.71	0.33	0.11	0.25	99.33	4.79
2001	13.03	0.80	0.54	3.30	20.28	1.11
2002	154.86	13.46	9.24	3.31	95.62	3.79
2003	6.01	0.28	0.15	3.74	28.18	0.80
2004	57.58	2.84	1.82	0.69	10.38	0.27
2005	19.22	0.55	0.10	1.32	4.50	0.07
2006	5.71	2.10	2.04	0.76	96.41	1.92
2007	10.60	0.36	0.14	1.16	41.52	2.21
2008	9.68	1.44	1.30		38.49	1.38

Table 21. NEFSC spring and fall trawl survey indices for scup. Spring and fall strata sets include only offshore strata 1-12, 23, 25 and 61-76 for consistency over entire time series. FSV *Bigelow* (HBB) and aggregate factor calibrated indices for the FSV *Albatross IV* (ALB) time series. The aggregate spring catch number calibration factor is 1.371; the aggregate spring weight factor is 0.701; the aggregate fall number factor is 1.740; the aggregate fall weight factor is 1.438.

Year	Spring N/tow HBB	Spring Kg/tow HBB	Spring N/tow ALB	Spring Kg/tow ALB
2009	11.98	0.99	8.74	1.41
2010	31.82	4.62	23.21	6.59
2011	26.67	0.92	19.45	1.31

Year	Fall N/tow HBB	Fall Kg/tow HBB	Fall N/tow ALB	Fall Kg/tow ALB
2009	160.99	3.85	92.52	2.68
2010	64.18	6.08	36.89	4.23

Table 22. NEFSC trawl survey spring and fall survey indices from the FSV Henry B. Bigelow (HBB) and length calibrated, equivalent indices for the FSV Albatross IV (ALB) time series. Spring and fall strata sets include only offshore strata 1-12, 23, 25 and 61-76 for consistency over entire time series. Indices are the sum of the stratified mean numbers (n) at length. The length calibration factors are for the lengths observed in the 2008 calibration experiment and include a constant swept area factor of 0.576. The effective total catch number calibration factors (HBB/ALB ratios) vary by year and season, depending on the characteristics of the HBB length frequency distributions.

Year	Spring (n) HBB	HBB CV	Spring (n) ALB	Effective Factor
2009	11.98	75.1	9.58	1.25
2010	31.82	35.8	27.30	1.17
2011	26.67	76.2	11.31	2.36

Year	Autumn (n) HBB	HBB CV	Autumn (n) ALB	Effective Factor
2009	160.99	34.8	50.79	3.17
2010	64.18	35.2	31.18	2.06

Table 23. NEFSC trawl survey spring and fall survey indices at age from the FSV Henry B. Bigelow (HBB) and equivalent indices at age for the FSV Albatross IV (ALB) time series. The spring strata set includes offshore strata 1-12, 23, 25, and 61-76. The fall strata set (aged set) includes offshore strata 1, 5, 9, 61, 65, 69, 73, and inshore strata 1-61, and is different from the fall set used in Tables 20-22. Indices at age are compiled after the application of length calibration factors including a constant swept area factor of 0.576. The effective catch number at age calibration factors (HBB/ALB ratios) vary by year and season, depending on the characteristics of the HBB length frequency distributions.

Spring

2009	0	1	2	3	4	5	6	7+	Total
HBB	0.00	4.56	6.95	0.28	0.13	0.03	0.01	0.02	11.98
ALB	0.00	2.34	6.69	0.33	0.16	0.03	0.01	0.02	9.58
HBB/ALB	0.00	1.95	1.04	0.85	0.81	1.00	1.00	1.00	1.25

2010	0	1	2	3	4	5	6	7+	Total
HBB	0.00	7.96	15.53	3.84	2.42	1.35	0.38	0.35	31.82
ALB	0.00	2.76	15.07	4.57	2.81	1.50	0.33	0.26	27.30
HBB/ALB	0.00	2.88	1.03	0.84	0.86	0.90	1.15	1.35	1.17

2011	0	1	2	3	4	5	6	7+	Total
HBB	0.00	25.41	0.58	0.35	0.25	0.08	0.01	0.00	26.67
ALB	0.00	9.95	0.57	0.41	0.29	0.08	0.01	0.00	11.31
HBB/ALB	0.00	2.55	1.02	0.85	0.86	1.00	1.00	0.00	2.36

Fall

2009	0	1	2	3	4	5	6	7+	Total
HBB	197.68	17.64	2.36	0.38	0.15	0.02	0.00	0.00	218.23
ALB	57.08	14.55	2.74	0.45	0.17	0.02	0.00	0.00	75.01
HBB/ALB	3.46	1.21	0.86	0.84	0.88	1.00	0.00	0.00	2.91

2010	0	1	2	3	4	5	6	7+	Total
HBB	64.16	2.09	2.92	2.27	1.99	0.43	0.09	0.01	73.96
ALB	31.06	2.98	5.99	4.63	3.83	0.73	0.13	0.01	49.36
HBB/ALB	2.07	0.70	0.49	0.49	0.52	0.59	0.69	1.00	1.50

Table 24. NEFSC spring trawl survey stratified mean number of scup per tow at age. Strata set includes only offshore strata 1-12, 23, 25, and 61-76.

Spring	Age														
Year	0	1	2	3	4	5	6	7	8	9	10	11	Total	age 2+	age 3+
1977		6.62	32.08	3.54	0.16	0.04	0.01	0.01					42.46	35.84	3.76
1978		26.90	4.67	6.50	1.31	0.32	0.12	0.03					39.85	12.95	8.28
1979		15.63	4.04	0.88	1.28	0.37	0.06	0.13	0.02	0.01			22.42	6.79	2.75
1980		2.39	5.61	0.57	0.17	0.25	0.15	0.08	0.08	0.01			9.31	6.92	1.31
1981		10.78	2.16	1.15	0.17	0.14	0.05	0.15	0.12				14.72	3.94	1.78
1982		3.80	1.77	1.39	0.38	0.17	0.13	0.07	0.07	0.10			7.88	4.08	2.31
1983		0.70	0.03	0.06				0.01					0.80	0.10	0.07
1984		6.14	1.97	0.22	0.12	0.07							8.52	2.38	0.41
1985		12.11	2.32	0.20	0.04								14.67	2.56	0.24
1986		1.05	10.26	0.43									11.74	10.69	0.43
1987		4.57	3.60	1.81	0.74	0.04	0.02	0.03	0.01				10.82	6.25	2.65
1988		16.74	8.36	0.17	0.03	0.01	0.03	0.07					25.41	8.67	0.31
1989		0.79	0.74	0.09	0.01								1.63	0.84	0.10
1990		0.12	0.30	0.30	0.18	0.09	0.13	0.05					1.17	1.05	0.75
1991		10.61	0.70	1.11	0.19								12.61	2.00	1.30
1992		5.72	0.88	0.07	0.05	0.06	0.01						6.79	1.07	0.19
1993		0.61	2.02	0.17	0.11	0.02							2.93	2.32	0.30
1994		1.34	0.16	0.04									1.54	0.20	0.04
1995		2.29	0.44	0.11	0.05	0.01							2.90	0.61	0.17
1996		0.44	0.05	0.03	0.01								0.53	0.09	0.04
1997		0.17	0.64	0.10									0.91	0.74	0.10
1998		39.90	0.12	0.02									40.04	0.14	0.02
1999		1.03	0.67										1.70	0.67	0.00
2000		5.93	0.71	0.07									6.71	0.78	0.07
2001		7.90	5.03	0.08		0.02							13.03	5.13	0.10
2002		109.01	15.60	26.67	3.27	0.31							154.86	45.85	30.25
2003		5.08	0.79	0.07	0.06								6.01	0.92	0.14
2004		38.69	16.15	1.31	0.82	0.60							57.58	18.89	2.74
2005		18.26	0.81	0.13	0.02								19.22	0.96	0.15
2006		1.56	0.51	0.80	0.35	0.70	1.69	0.10					5.71	4.15	3.64
2007		9.73	0.41	0.44	0.00	0.01	0.01						10.60	0.87	0.46
2008		0.40	5.82	2.92	0.18	0.09	0.15	0.05	0.07				9.68	9.28	3.46

Table 24, continued. NEFSC spring trawl survey stratified mean number of scup per tow at age. Strata set includes only offshore strata 1-12, 23, 25, and 61-76. HBB indices length calibrated to ALB equivalents (see Table 23).

Spring	Age														
Year	0	1	2	3	4	5	6	7	8	9	10	11	Total	age 2+	age 3+
2009		2.34	6.69	0.33	0.16	0.03	0.01	0.01	0.01				9.58	7.24	0.55
2010		2.77	15.07	4.57	2.81	1.50	0.33	0.08	0.16		0.02		27.30	24.53	9.46
2011		9.95	0.57	0.41	0.29	0.08	0.01			0.004			11.31	1.36	0.79

Table 25. NEFSC fall trawl survey stratified mean number of scup per tow at age. Strata set includes offshore strata 1-12, 23, 25, 61-76, and inshore strata 1-61.

Fall	Age														
Year	0	1	2	3	4	5	6	7	8	9	10	11	Total	age 2+	age 3+
1984	47.64	9.20	0.34	0.03	0.01		0.01						59.96	0.39	0.05
1985	61.22	11.53	1.10	0.26	0.06	0.05							74.71	1.47	0.37
1986	70.19	6.58	0.57		0.01								77.36	0.58	0.01
1987	49.93	29.85	0.46	0.01									80.45	0.47	0.01
1988	47.44	15.95	0.67	0.10									64.22	0.77	0.10
1989	176.37	25.92	0.66	0.03									202.99	0.69	0.03
1990	77.45	9.21	0.75	0.04									87.46	0.79	0.04
1991	151.62	12.51	0.07	0.02									164.24	0.09	0.02
1992	25.92	14.51	1.66	0.04	0.02								42.15	1.72	0.06
1993	46.78	9.76	0.32										56.86	0.32	0.00
1994	39.54	3.92	0.04	0.01									43.52	0.05	0.01
1995	33.04	2.61	0.08	0.01									35.74	0.09	0.01
1996	24.42	2.86	0.43	0.01									27.73	0.44	0.01
1997	46.91	0.61	0.02		0.01								47.66	0.03	0.01
1998	57.73	9.64	0.09	0.03	0.01								67.50	0.13	0.04
1999	96.06	9.77	1.37	0.07	0.01								107.28	1.45	0.08
2000	98.72	20.60	3.14	0.48	0.11	0.07							123.12	3.80	0.66
2001	91.84	10.32	1.82	0.12	0.04	0.01							104.15	1.99	0.17
2002	180.09	43.31	0.90	0.35	0.04	0.01							224.70	1.30	0.40
2003	53.70	5.66	2.30	1.33	0.82	0.20	0.02						64.02	4.67	2.37
2004	41.83	33.46	1.14	1.70	0.39	0.12	0.04	0.01					78.69	3.40	2.26
2005	27.26	7.94	1.02	0.14	0.04	0.04							36.43	1.23	0.21
2006	146.85	20.08	0.92	0.07	0.05	0.01	0.03	0.01					168.02	1.09	0.17
.2007	113.95	40.28	0.60	0.24	0.05	0.03	0.05	0.02					155.22	0.99	0.39
2008	70.43	65.48	0.52	0.06	0.01								136.50	0.59	0.07

Table 25, continued. NEFSC fall trawl survey stratified mean number of scup per tow at age. Strata set includes offshore strata 1-12, 23, 25, 61-76, and inshore strata 1-61. HBB indices length calibrated to ALB equivalents (see Table 23).

Fall	Age														
Year	0	1	2	3	4	5	6	7	8	9	10	11	Total	age 2+	age 3+
2009	57.08	14.55	2.74	0.45	0.17	0.02							75.01	17.93	3.38
2010	31.06	2.98	5.99	4.63	3.83	0.73	0.13		0.01				49.36	18.30	15.32

Table 26. NEFSC 1992-2007 Winter trawl survey indices of abundance for scup, offshore survey strata 1-12 and 61-76. The winter survey ended in 2007.

Year	Mean number per tow	Mean kg per tow
1992	65.56	2.87
1993	25.71	2.73
1994	17.09	0.66
1995	69.50	2.26
1996	18.28	1.19
1997	13.90	0.32
1998	46.92	1.20
1999	15.04	0.71
2000	24.21	1.33
2001	55.49	1.58
2002	267.83	7.56
2003	24.16	0.49
2004	380.59	3.82
2005	84.74	1.96
2006	201.96	3.72
2007	101.08	2.95

Table 27. NEFSC 1992-2007 winter trawl survey stratified mean number of scup per tow at age, offshore survey strata 1-12 and 61-76. The 1992, 1993, and 1996 lengths are aged with the corresponding annual spring survey age-length key. The winter survey ended in 2007.

Winter	Age											
Year	0	1	2	3	4	5	6	7	8	Total	age 2+	age 3+
1992		57.61	4.75	0.19	0.09	0.10	0.45			63.18	5.57	0.82
1993		2.51	22.05	0.56	0.57	0.02				25.71	23.19	1.15
1994		16.31	0.73	0.02	0.02	0.01				17.09	0.78	0.05
1995		64.94	1.87	0.15	0.01	0.01	0.02	0.01		67.01	2.07	0.20
1996		12.95	5.31	0.03	0.01					18.29	5.34	0.04
1997		13.27	0.52	0.11						13.90	0.64	0.11
1998		45.62	0.75	0.22	0.21	0.08	0.03	0.01		46.92	1.30	0.55
1999		12.48	2.41	0.12	0.02	0.01				15.04	2.56	0.15
2000		20.28	3.21	0.68	0.03			0.01		24.21	3.93	0.72
2001		48.54	6.48	0.36	0.09	0.02				55.49	6.95	0.47
2002		257.08	7.44	2.96	0.33	0.01	0.01			267.83	10.75	3.31
2003		23.77	0.28	0.07	0.03		0.02			24.16	0.39	0.11
2004		380.22	0.29	0.07	0.01					380.59	0.37	0.08
2005		80.03	4.62	0.09						84.74	4.71	0.09
2006		198.52	2.64	0.66	0.03	0.04	0.07			201.96	3.44	0.80
2007		99.18	1.86	0.02	0.02					101.08	1.90	0.04

Table 28. NEFSC trawl survey winter, spring and fall survey maximum-length restricted biomass indices from the FSV Albatross IV (ALB) and length calibrated, ALB equivalent indices from the FSV Henry B. Bigelow (HBB) for the spring and fall time series. Spring and fall strata sets include only offshore strata 1-12, 23, 25 and 61-76 for consistency over entire time series. These are the aggregate biomass indices for ages 0-2 used in the stock assessment ASAP model calibration.

Year	Winter	Winter CV	Spring	Spring CV	Fall	Fall CV
1963					0.03	64.2
1964					2.19	86.7
1965					0.39	65.7
1966					0.05	49.0
1967					1.43	72.0
1968			1.58	81.7	0.55	46.4
1969			0.16	96.6	4.18	66.0
1970			2.78	71.4	0.30	66.5
1971			3.03	82.6	0.29	37.1
1972			2.12	57.3	2.47	41.4
1973			0.18	42.5	0.93	38.3
1974			1.52	54.4	0.77	34.4
1975			1.27	70.7	2.69	23.1
1976			0.24	35.0	7.43	50.1
1977			5.03	92.4	1.52	21.9
1978			1.92	80.0	0.73	23.0
1979			1.07	63.2	0.57	26.3
1980			0.84	82.1	0.90	50.2
1981			0.74	36.4	3.21	37.6
1982			0.37	41.3	1.04	50.7
1983			0.02	46.2	0.34	37.6
1984			0.56	70.2	1.35	62.0
1985			0.81	90.9	3.66	26.3
1986			1.42	58.9	1.86	60.9
1987			0.73	74.2	0.15	56.1
1988			1.48	68.6	0.10	69.8
1989			0.12	77.7	3.99	48.1
1990			0.06	38.0	0.97	40.5
1991			0.50	21.5	0.50	47.1
1992	2.86	45.2	0.35	37.7	1.16	39.2
1993	2.99	86.1	0.26	78.7	0.05	95.8
1994	0.67	8.6	0.08	83.6	0.09	68.3
1995	2.99	68.7	0.16	37.1	1.10	59.0
1996	1.22	62.3	0.03	62.5	0.26	57.0
1997	0.43	63.4	0.09	41.4	1.02	98.1
1998	1.48	45.2	1.31	22.9	0.90	36.1
1999	0.69	46.9	0.14	69.4	2.52	35.9
2000	1.64	55.1	0.41	45.6	5.01	56.0
2001	2.15	41.9	0.98	57.9	1.16	45.1
2002	10.78	54.1	7.53	68.0	4.65	40.7
2003	0.75	69.0	0.30	39.5	0.64	63.8
2004	6.42	83.9	3.13	65.1	0.17	45.6
2005	2.93	41.9	0.81	57.3	0.07	76.0
2006	6.36	39.7	0.18	63.7	2.68	38.1
2007	3.46	57.4	0.37	65.6	2.40	56.3
2008			1.02	90.7	1.74	67.5
2009			1.05	90.1	2.32	28.7
2010			2.32	46.4	2.42	36.1
2011			0.49	69.6		

Table 29. MADMF trawl survey mean number of scup per tow and mean weight (kg) per tow for spring (survey regions 1-3) and fall (survey regions 1-5).

	Spring		Fall	
Year	No./Tow	Kg/tow	No./Tow	Kg/Tow
1978	90.08	31.71	1859.40	14.82
1979	76.14	18.05	1150.16	12.20
1980	189.82	41.39	1183.02	12.53
1981	298.53	17.63	971.87	14.34
1982	10.46	0.98	2153.76	9.17
1983	25.29	3.51	1623.13	12.90
1984	17.90	6.53	963.49	12.29
1985	67.02	3.40	647.63	12.09
1986	44.17	7.35	773.61	9.15
1987	6.05	1.37	561.61	7.72
1988	13.98	2.09	1396.86	14.15
1989	13.32	2.02	580.73	7.77
1990	144.06	21.45	1128.07	7.21
1991	28.73	6.05	1150.71	10.18
1992	14.49	2.52	2440.96	11.54
1993	19.13	4.23	1023.11	10.06
1994	9.71	2.85	820.31	9.84
1995	49.29	2.76	507.02	4.11
1996	5.18	0.68	1019.96	9.15
1997	3.22	0.71	921.21	7.25
1998	1.37	0.21	709.61	6.94
1999	11.61	1.93	1212.23	18.07
2000	307.00	18.02	867.00	11.63
2001	7.28	2.37	1205.60	9.89
2002	281.36	18.77	1137.64	8.32
2003	0.22	0.07	3209.61	14.87
2004	41.71	13.04	1483.56	10.07
2005	9.32	3.25	4005.89	21.53
2006	92.97	22.41	1231.49	9.46
2007	13.30	2.03	1774.23	11.65
2008	145.72	27.89	743.19	10.78
2009	82.72	16.02	1087.38	14.10
2010	72.22	12.66	1424.47	14.92

Table 30. RIDFW trawl survey mean number of scup per tow and mean weight (kg) per tow for spring and fall.

	Spring		Fall	
Year	No./Tow	Kg/tow	No./Tow	Kg/Tow
1981	12.49	0.40	196.22	2.54
1982	0.43	0.04	63.87	0.70
1983	3.59	0.32	173.63	2.75
1984	13.24	0.88	589.68	10.57
1985	8.30	0.41	74.27	1.51
1986	1.78	0.33	340.06	4.20
1987	0.04	0.01	314.20	4.73
1988	0.23	0.04	804.00	7.10
1989	0.17	0.04	326.86	6.62
1990	0.64	0.15	527.31	5.66
1991	2.93	0.57	655.69	16.62
1992	1.88	0.61	1105.51	9.10
1993	1.12	0.06	1246.35	8.90
1994	2.08	0.53	236.12	3.66
1995	4.33	0.53	423.02	5.03
1996	0.52	0.07	184.73	3.83
1997	1.93	0.15	597.90	6.04
1998	0.15	0.03	150.38	1.89
1999	0.38	0.07	832.22	12.39
2000	84.05	3.54	588.73	9.11
2001	29.68	5.08	1139.17	11.07
2002	174.80	10.28	716.12	9.27
2003	0.00	0.00	1181.83	11.38
2004	2.59	0.45	1616.24	9.58
2005	2.95	1.63	2216.72	21.35
2006	53.12	3.90	765.90	11.26
2007	1.95	0.24	2410.00	23.76
2008	0.19	0.04	705.10	18.15
2009	1.14	0.39	1705.33	24.99
2010	2.14	0.56	760.14	17.39

Table 31. RIDFW industry cooperative ventless trap survey: mean number of scup per trap per soak time.

Age/Year	0	1	2	3	4	5	6	7	8+	Total
2005	0.014	0.306	0.904	0.980	0.352	0.391	0.071	0.026	0.003	3.047
2006	0.031	0.472	1.337	0.803	0.263	0.214	0.189	0.125	0.046	3.481
2007	0.041	0.661	1.397	2.204	0.385	0.199	0.628	0.170	0.051	5.735
2008	0.005	0.794	1.664	2.875	0.824	0.352	0.202	0.039	0.068	6.823
2009	0.028	1.557	2.313	3.840	1.150	0.578	0.436	0.068	0.051	10.021
2010	0.112	0.699	4.311	3.897	1.985	0.481	0.408	0.134	0.002	12.029

Table 32. CTDEP spring trawl survey mean number of scup per tow at age, total mean number per tow, and total mean weight (kg) per tow. No survey in 2010.

							Age								Total	Total	Age
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	No./Tow	Kg/Tow	2+
1984	0.49	1.31	0.59	0.30	0.08	0.00	0.00	0.00	0.00	0.03	0.02	0.00	0.00	0.00	2.80	0.64	2.31
1985	2.94	2.00	0.33	0.24	0.05	0.02	0.05	0.00	0.00	0.01	0.00	0.00	0.00	0.00	5.61	1.22	2.71
1986	4.44	1.65	0.99	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.40	0.78	2.79
1987	0.43	1.65	0.07	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17	0.37	1.76
1988	1.18	0.30	0.51	0.05	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.11	0.32	0.88
1989	5.63	0.56	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.77	0.63	0.62
1990	2.56	2.06	0.21	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.25	0.61	2.30
1991	4.25	1.44	1.26	0.09	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.09	0.94	2.80
1992	0.39	1.21	0.09	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.75	0.48	1.36
1993	0.04	2.29	0.19	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.32	0.49	2.49
1994	0.81	2.03	0.93	0.10	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.88	0.58	3.09
1995	12.94	0.39	0.20	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.24	0.65	0.64
1996	5.20	2.48	0.07	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.25	0.73	2.56
1997	3.16	2.61	1.68	0.06	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.23	0.75	4.39
1998	10.07	0.58	0.12	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.25	0.75	0.76
1999	2.71	1.75	0.16	0.07	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.22	0.56	2.02
2000	124.51	17.18	4.24	0.20	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.46	4.56	21.71
2001	1.65	18.99	1.57	0.25	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.20	2.85	20.84
2002	49.15	66.61	123.25	17.44	1.29	0.10	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	257.91	13.16	208.76
2003	0.14	4.05	3.28	4.96	0.61	0.07	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	13.12	2.28	12.98
2004	0.01	3.97	8.96	4.90	8.21	0.76	0.08	0.02	0.01	0.00	0.00	0.00	0.00	0.00	26.92	3.93	26.90
2005	1.16	1.28	1.06	1.51	1.27	1.94	0.22	0.05	0.00	0.00	0.00	0.00	0.00	0.00	8.49	1.65	7.33
2006	18.48	23.72	5.63	2.07	2.56	3.16	2.90	0.53	0.01	0.00	0.00	0.00	0.00	0.00	59.06	10.41	40.58
2007	7.51	15.86	5.84	1.49	0.55	0.54	0.54	0.39	0.07	0.01	0.00	0.00	0.00	0.00	32.80	3.32	25.29
2008	16.96	40.62	27.82	4.94	0.91	0.16	0.30	0.24	0.15	0.02	0.00	0.00	0.00	0.00	92.10	5.88	75.14
2009	31.61	28.23	28.41	12.49	2.50	0.61	0.21	0.13	0.25	0.00	0.00	0.00	0.00	0.00	104.45	6.40	72.84

Table 33. CTDEP fall trawl survey mean number of scup per tow at age, total mean number per tow, and total mean weight (kg) per tow. No survey in 2010.

							Age					Total	Total	Age
Year	0	1	2	3	4	5	6	7	8	9	10	No/Tow	Kg/Tow	2+
1984	7.99	1.04	0.78	0.52	0.28	0.09	0.02	0.00	0.00	0.00	0.00	10.72	1.36	1.69
1985	25.01	4.71	0.40	0.59	0.19	0.04	0.03	0.00	0.00	0.00	0.00	30.97	2.50	1.25
1986	13.06	9.98	2.50	0.19	0.01	0.01	0.01	0.00	0.00	0.00	0.00	25.76	2.95	2.72
1987	12.47	4.17	1.25	0.58	0.06	0.01	0.01	0.00	0.00	0.00	0.00	18.55	1.79	1.91
1988	31.89	5.71	1.82	0.24	0.03	0.00	0.00	0.00	0.00	0.00	0.00	39.69	2.27	2.09
1989	40.88	22.60	1.51	0.08	0.01	0.00	0.00	0.00	0.00	0.00	0.00	65.08	3.65	1.60
1990	54.34	7.74	6.95	0.40	0.03	0.01	0.01	0.00	0.00	0.01	0.00	69.49	5.00	7.41
1991	291.58	17.03	1.76	1.04	0.15	0.01	0.00	0.00	0.00	0.00	0.00	311.57	8.30	2.96
1992	50.91	26.58	5.54	0.40	0.29	0.01	0.01	0.00	0.00	0.00	0.00	83.74	4.96	6.25
1993	74.06	1.83	1.02	0.12	0.01	0.01	0.00	0.00	0.00	0.00	0.00	77.05	3.72	1.16
1994	90.76	1.12	0.46	0.18	0.01	0.00	0.00	0.00	0.00	0.00	0.00	92.53	3.33	0.65
1995	32.46	26.52	0.14	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.13	4.63	0.15
1996	51.50	8.56	1.37	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	61.47	3.68	1.41
1997	31.79	8.68	0.63	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	41.28	2.49	0.81
1998	90.40	12.24	0.54	0.07	0.02	0.00	0.00	0.00	0.00	0.00	0.00	103.27	4.50	0.63
1999	498.18	30.93	8.35	0.19	0.02	0.01	0.00	0.00	0.00	0.00	0.00	537.68	22.72	8.57
2000	250.39	261.45	8.32	0.79	0.14	0.01	0.00	0.00	0.00	0.00	0.00	521.10	30.76	9.26
2001	140.51	16.90	18.42	1.61	0.19	0.03	0.00	0.00	0.00	0.00	0.00	177.66	11.28	20.25
2002	259.90	47.62	23.32	16.81	0.67	0.33	0.05	0.00	0.01	0.00	0.00	348.70	23.69	41.18
2003	52.91	15.35	32.07	22.39	26.44	2.49	0.54	0.02	0.02	0.00	0.00	152.23	28.95	83.96
2004	251.05	4.13	8.34	15.08	5.98	6.25	0.53	0.07	0.01	0.02	0.00	291.46	16.31	36.28
2005	373.32	32.56	8.14	2.44	4.01	1.50	1.69	0.33	0.06	0.00	0.00	424.05	13.79	18.17
2006	52.16	51.02	9.52	2.34	0.26	0.35	0.38	0.68	0.04	0.00	0.00	116.75	10.49	13.57
2007	319.89	118.06	29.34	5.93	0.90	0.23	0.30	0.31	0.31	0.03	0.00	475.30	24.42	37.35
2008	243.68	35.10	11.92	7.04	3.56	1.05	0.50	0.14	0.12	0.14	0.00	303.26	16.53	24.48
2009	67.49	40.39	20.79	6.93	2.61	0.74	0.21	0.13	0.07	0.02	0.00	139.38	13.73	31.51

Table 34. NYDEC small mesh trawl survey indices at ages 0, 1 and 2 and older (2+); NJBMF trawl survey mean number of scup per tow and mean weight (kg) per tow; VIMS age 0 index.

	NYDEC Trawl			NJBMF Trawl		VIMS
Year	Age 0	Age 1	Age 2+	No/tow	Kg/tow	Age 0
1987	0.33	3.43	0.09			2.07
1988	1.19	1.96	0.05			3.06
1989	0.67	11.02	0.04	72.75	2.75	4.81
1990	5.32	1.30	0.14	74.72	3.77	1.90
1991	13.17	2.31	0.22	200.61	6.17	0.65
1992	15.25	1.54	0.06	227.70	7.16	3.30
1993	0.29	0.72	0.04	256.91	5.21	0.90
1994	6.11	0.36	0.06	86.45	3.30	0.39
1995	0.61	7.49	0.03	27.13	2.08	0.54
1996	0.42	0.94	0.15	30.81	1.04	0.21
1997	20.23	0.74	0.20	52.09	3.82	0.50
1998	73.22	1.46	0.05	220.06	4.88	0.27
1999	35.85	2.25	0.03	209.10	10.30	0.13
2000	186.07	16.73	1.02	260.97	6.56	1.34
2001	83.01	2.99	1.22	163.37	4.32	0.24
2002	346.32	5.47	6.01	565.96	25.65	0.96
2003	266.56	0.38	1.35	804.08	10.19	0.46
2004	40.82	0.92	0.70	449.12	11.70	1.11
2005	n/a	n/a	n/a	147.98	4.19	1.58
2006	n/a	n/a	n/a	943.63	16.52	2.99
2007	109.47	4.18	0.61	1185.54	38.27	0.20
2008	n/a	n/a	n/a	141.17	3.19	2.97
2009	79.10	4.76	0.73	205.66	6.04	4.11
2010	7.83	2.17	3.86	141.11	2.21	

Table 35. University of Rhode Island Graduate School of Oceanography (URIGSO) trawl survey indices for scup (total catch number): Fox Island station.

Year	Fox Is	Year	Fox Is
1959	87.713	2000	279.488
1960	21.772	2001	108.717
1961	21.325	2002	109.125
1962	7.754	2003	51.953
1963	51.982	2004	58.358
1964	55.408	2005	141.163
1965	35.817	2006	187.940
1966	16.394	2007	257.338
1967	106.604	2008	298.097
1968	30.292	2009	330.836
1969	19.068	2010	227.854
1970	17.371		
1971	76.188		
1972	37.683		
1973	109.514		
1974	55.249		
1975	166.406		
1976	408.007		
1977	287.300		
1978	148.249		
1979	139.350		
1980	80.211		
1981	122.392		
1982	56.950		
1983	189.271		
1984	160.896		
1985	187.582		
1986	158.563		
1987	106.625		
1988	99.863		
1989	358.521		
1990	131.329		
1991	256.358		
1992	80.353		
1993	261.838		
1994	55.640		
1995	90.829		
1996	83.663		
1997	62.096		
1998	56.208		
1999	268.650		

Table 36. VIMS ChesMMAP trawl survey indices for scup. Indices are delta-lognormal model stratified geometric mean numbers (N) and biomass per tow.

Year	Number (CV %)	Biomass (CV %)
2002	123.4 (118)	7.8 (273)
2003	171.5 (35)	9.8 (33)
2004	358.7 (144)	20.0 (141)
2005	1,369.7 (59)	64.7 (54)
2006	420.4 (47)	16.1 (53)
2007	333.0 (38)	11.5 (34)
2008	40.8 (53)	2.5 (71)
2009	314.1 (41)	10.1 (41)
2010	1,460.5 (59)	49.1 (60)

Table 37. VIMS NEAMAP trawl survey indices for scup. Indices are calculated as delta-lognormal model stratified geometric mean catch per standard area swept tow.

Season	Number/tow (CV %)	Kilogram/tow (CV %)
Fall 2007	117.20 (4.0)	7.49 (5.6)
Fall 2008	24.82 (5.1)	3.16 (6.6)
Fall 2009	39.11 (4.4)	3.82 (5.6)
Fall 2010	28.50 (4.9)	3.15 (7.5)
Spring 2008	32.54 (3.9)	2.36 (6.4)
Spring 2009	8.28 (6.3)	1.49 (10.8)
Spring 2010	2.27 (7.2)	0.79 (10.7)
Spring 2011	2.45 (7.8)	0.62 (14.6)

Table 38. Summary assessment results; Spawning Stock Biomass (SSB) in metric tons (mt); Recruitment (R) at age 0 in millions; Fishing Mortality (F) for fully recruited ages 2-7+.

Year	SSB	R	F
1984	18,142	108	0.535
1985	16,963	73	0.600
1986	15,783	60	0.752
1987	13,283	55	0.699
1988	9,551	100	0.735
1989	8,056	59	0.710
1990	8,828	118	0.684
1991	8,360	106	1.056
1992	7,353	41	1.120
1993	5,985	44	1.072
1994	4,389	77	1.098
1995	3,959	36	0.882
1996	5,063	23	0.703
1997	5,794	81	0.472
1998	6,410	104	0.375
1999	10,412	204	0.241
2000	20,242	222	0.170
2001	41,657	142	0.094
2002	68,049	93	0.097
2003	90,745	84	0.097
2004	102,611	133	0.063
2005	114,758	146	0.051
2006	122,199	173	0.053
2007	135,098	160	0.054
2008	160,655	212	0.046
2009	161,332	88	0.034
2010	186,262	44	0.040

Table 39. January 1 population number (N, 000s) estimates at age.

N	Age							
	0	1	2	3	4	5	6	7+
1984	107,505	58,252	25,144	6,657	2,606	5,713	5,254	13,817
1985	73,241	79,890	38,349	11,393	3,298	1,241	2,719	9,438
1986	59,980	53,892	51,086	16,314	5,367	1,460	549	5,695
1987	54,466	44,792	34,684	21,979	6,553	1,941	528	2,509
1988	99,498	40,294	28,649	14,570	9,306	2,562	758	1,282
1989	59,256	74,335	26,239	12,368	5,864	3,467	954	807
1990	118,115	44,226	48,124	11,382	5,172	2,237	1,322	704
1991	106,233	87,453	28,397	20,381	4,886	2,060	890	832
1992	41,147	75,701	50,567	8,982	6,115	1,291	544	489
1993	43,714	27,963	40,196	12,833	2,575	1,575	332	283
1994	76,804	30,938	16,069	12,287	3,746	677	414	172
1995	35,731	55,884	18,667	5,477	3,410	931	168	152
1996	22,695	25,555	33,351	6,371	1,933	1,116	305	110
1997	81,348	16,816	16,441	14,066	2,667	754	435	165
1998	104,170	60,978	10,998	8,013	7,102	1,351	382	314
1999	203,661	77,557	39,519	5,401	4,558	4,054	771	410
2000	222,053	158,247	55,693	24,061	3,477	2,940	2,615	775
2001	142,364	176,958	120,688	38,487	16,507	2,388	2,019	2,349
2002	93,447	114,507	138,478	89,490	28,603	12,274	1,775	3,278
2003	84,226	73,933	86,386	96,112	67,156	21,492	9,224	3,831
2004	132,851	67,373	57,146	62,683	71,430	49,948	15,986	9,769
2005	145,986	107,313	53,336	43,652	48,111	54,846	38,353	19,875
2006	173,297	118,059	85,252	41,298	33,930	37,409	42,647	45,453
2007	160,142	139,624	93,018	65,298	32,101	26,385	29,092	68,838
2008	211,918	128,978	109,896	70,774	50,757	24,965	20,521	76,602
2009	87,889	170,534	101,366	83,377	55,550	39,861	19,607	76,651
2010	44,429	71,057	135,509	78,473	66,147	44,089	31,639	76,681

Table 40. Fishing mortality (F) estimates at age.

F	Age							
	0	1	2	3	4	5	6	7+
1984	0.097	0.218	0.592	0.502	0.542	0.543	0.544	0.488
1985	0.107	0.247	0.655	0.553	0.615	0.616	0.617	0.542
1986	0.092	0.241	0.643	0.712	0.817	0.817	0.818	0.702
1987	0.101	0.247	0.667	0.659	0.739	0.740	0.741	0.647
1988	0.092	0.229	0.640	0.710	0.787	0.788	0.789	0.694
1989	0.093	0.235	0.635	0.672	0.764	0.764	0.765	0.661
1990	0.101	0.243	0.659	0.646	0.721	0.721	0.722	0.633
1991	0.139	0.348	0.951	1.004	1.131	1.131	1.133	0.985
1992	0.186	0.433	1.171	1.049	1.156	1.157	1.159	1.025
1993	0.146	0.354	0.985	1.031	1.136	1.137	1.138	1.006
1994	0.118	0.305	0.876	1.082	1.192	1.192	1.193	1.054
1995	0.135	0.316	0.875	0.842	0.917	0.918	0.919	0.819
1996	0.100	0.241	0.663	0.671	0.742	0.742	0.743	0.655
1997	0.088	0.225	0.519	0.483	0.480	0.480	0.462	0.408
1998	0.095	0.234	0.511	0.364	0.361	0.360	0.347	0.308
1999	0.052	0.131	0.296	0.240	0.239	0.238	0.231	0.202
2000	0.027	0.071	0.170	0.177	0.176	0.176	0.173	0.147
2001	0.018	0.045	0.099	0.097	0.096	0.096	0.094	0.081
2002	0.034	0.082	0.165	0.087	0.086	0.086	0.083	0.074
2003	0.023	0.058	0.121	0.097	0.096	0.096	0.094	0.081
2004	0.013	0.034	0.069	0.065	0.064	0.064	0.062	0.054
2005	0.012	0.030	0.056	0.052	0.052	0.052	0.050	0.044
2006	0.016	0.038	0.067	0.052	0.051	0.051	0.050	0.044
2007	0.016	0.039	0.073	0.052	0.051	0.051	0.050	0.044
2008	0.017	0.041	0.076	0.042	0.042	0.042	0.040	0.036
2009	0.013	0.030	0.056	0.031	0.031	0.031	0.030	0.027
2010	0.016	0.037	0.066	0.037	0.036	0.036	0.035	0.031

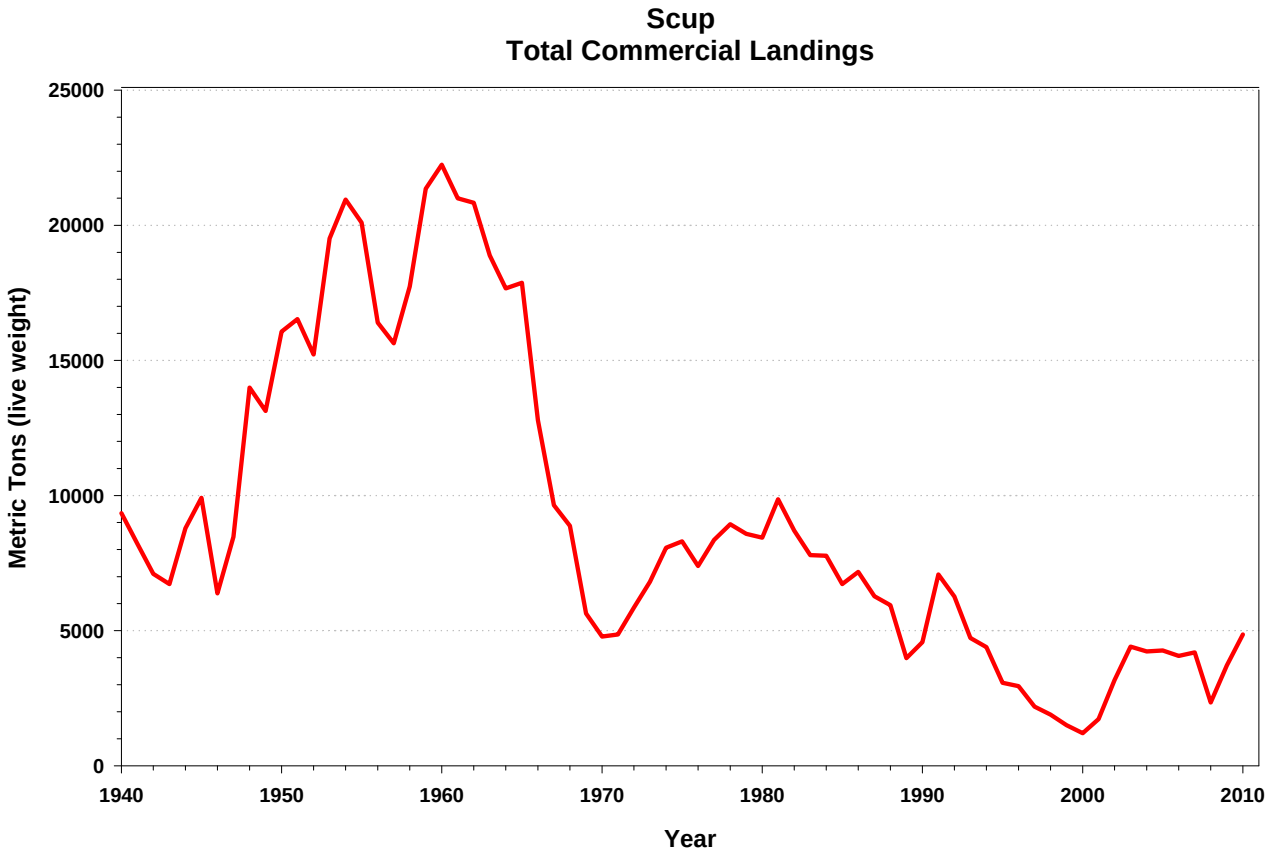


Figure 1. Total commercial fishery landings for scup.

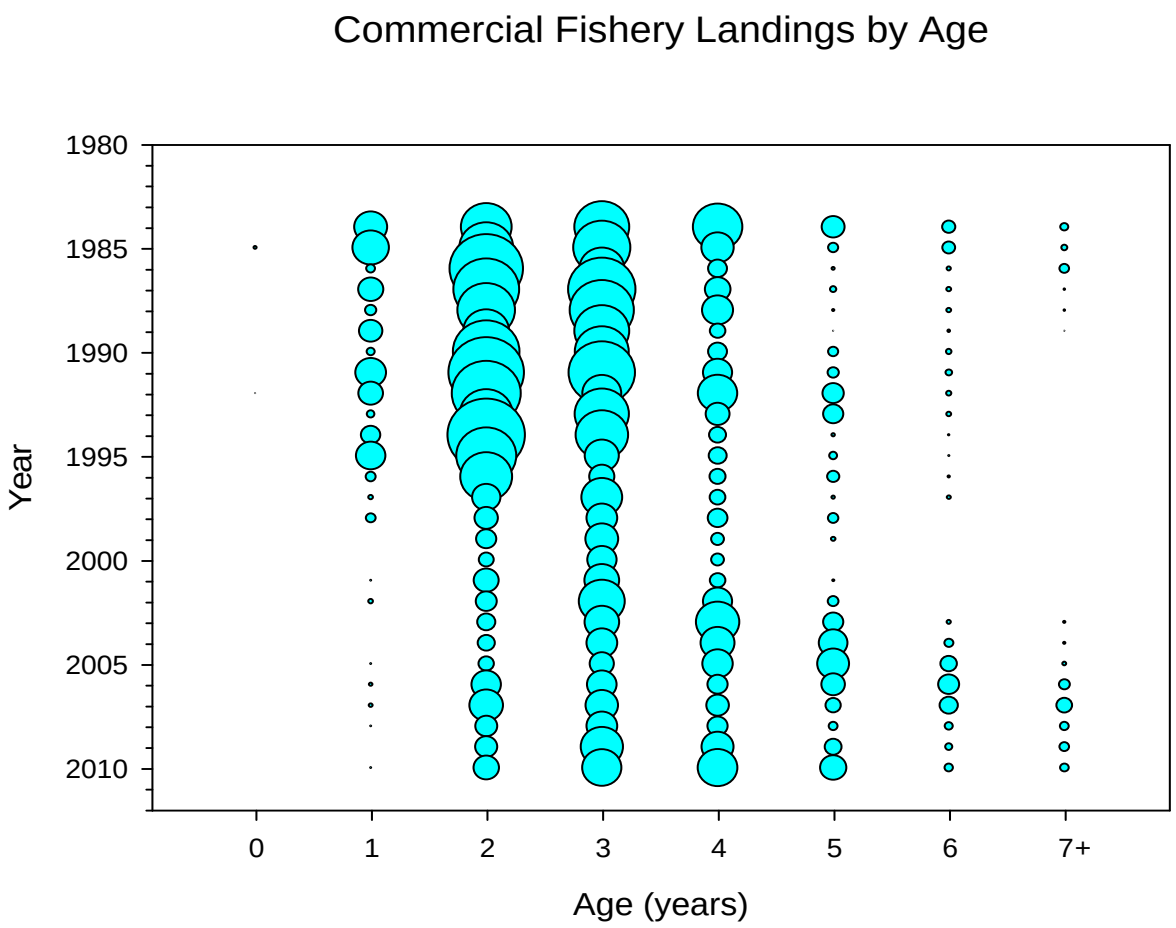


Figure 2. Commercial fishery landings by age for scup.

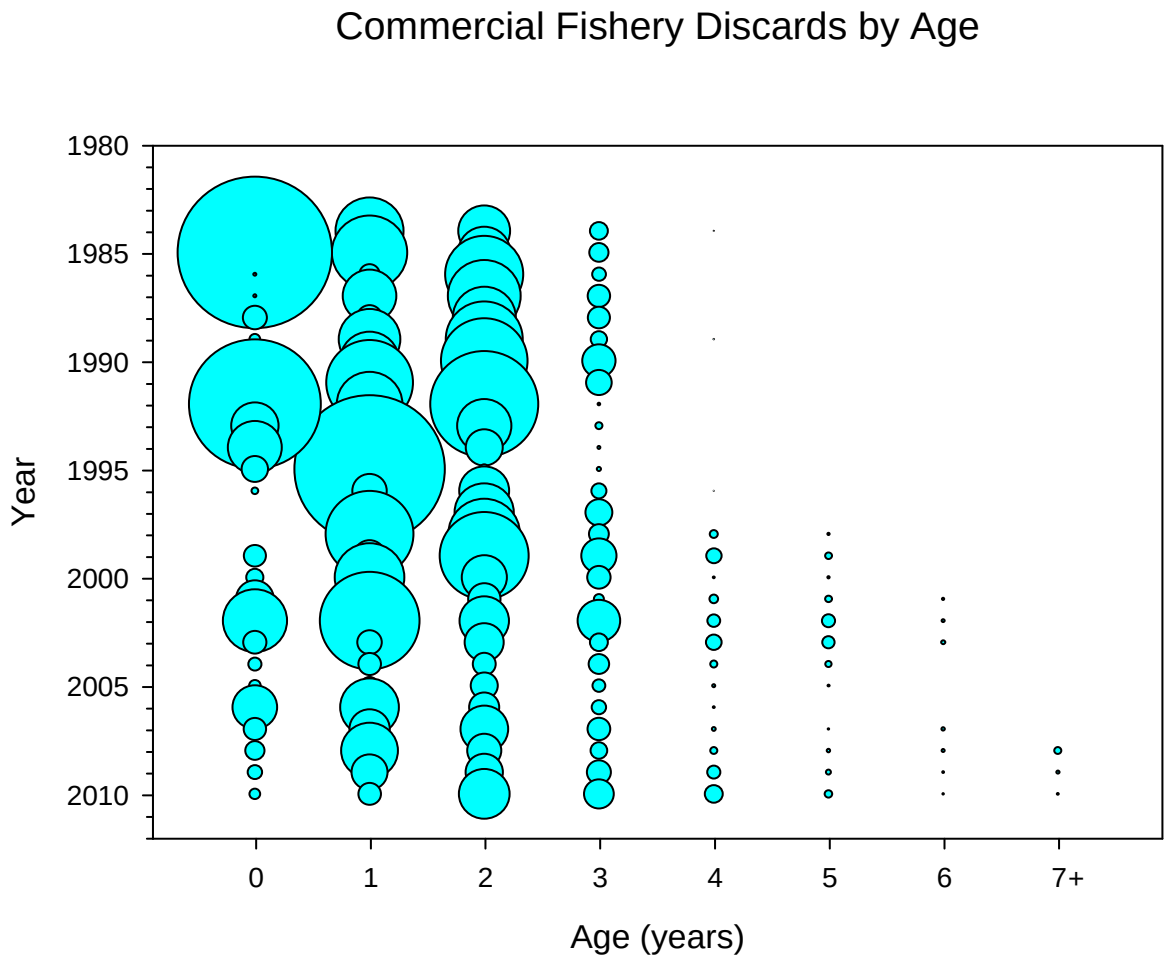


Figure 3. Commercial fishery discards by age for scup.

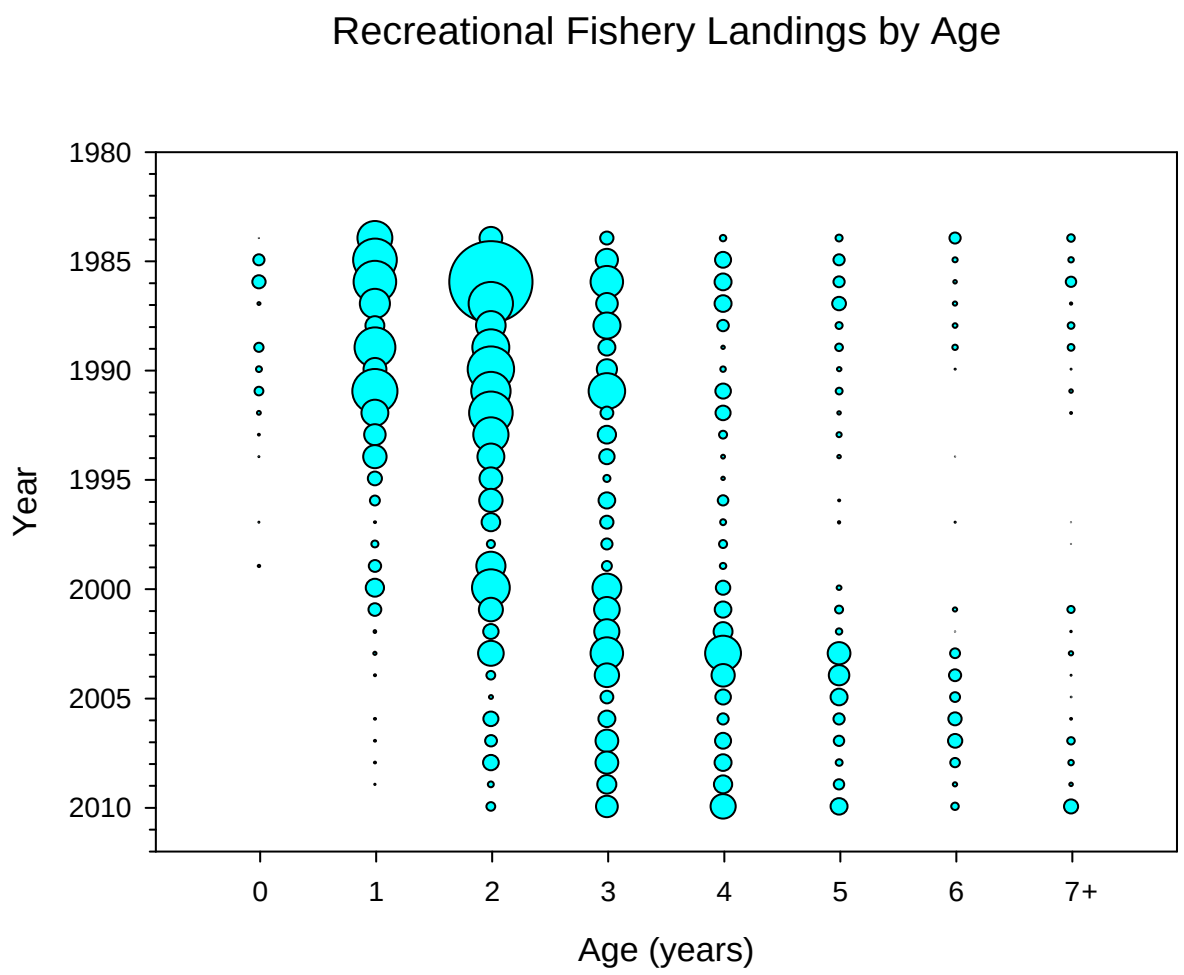


Figure 4. Recreational fishery landings by age for scup.

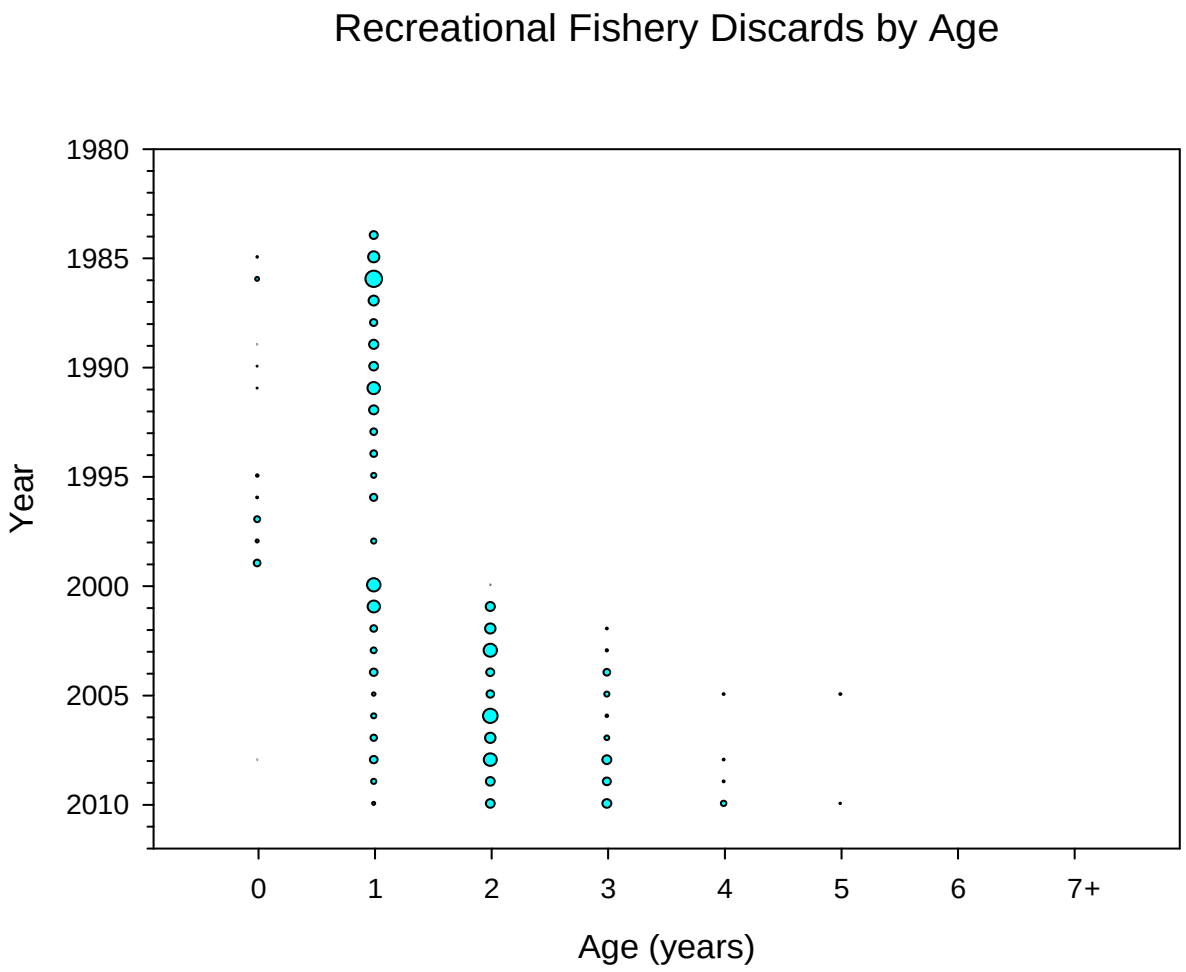


Figure 5. Recreational fishery discards by age for scup.

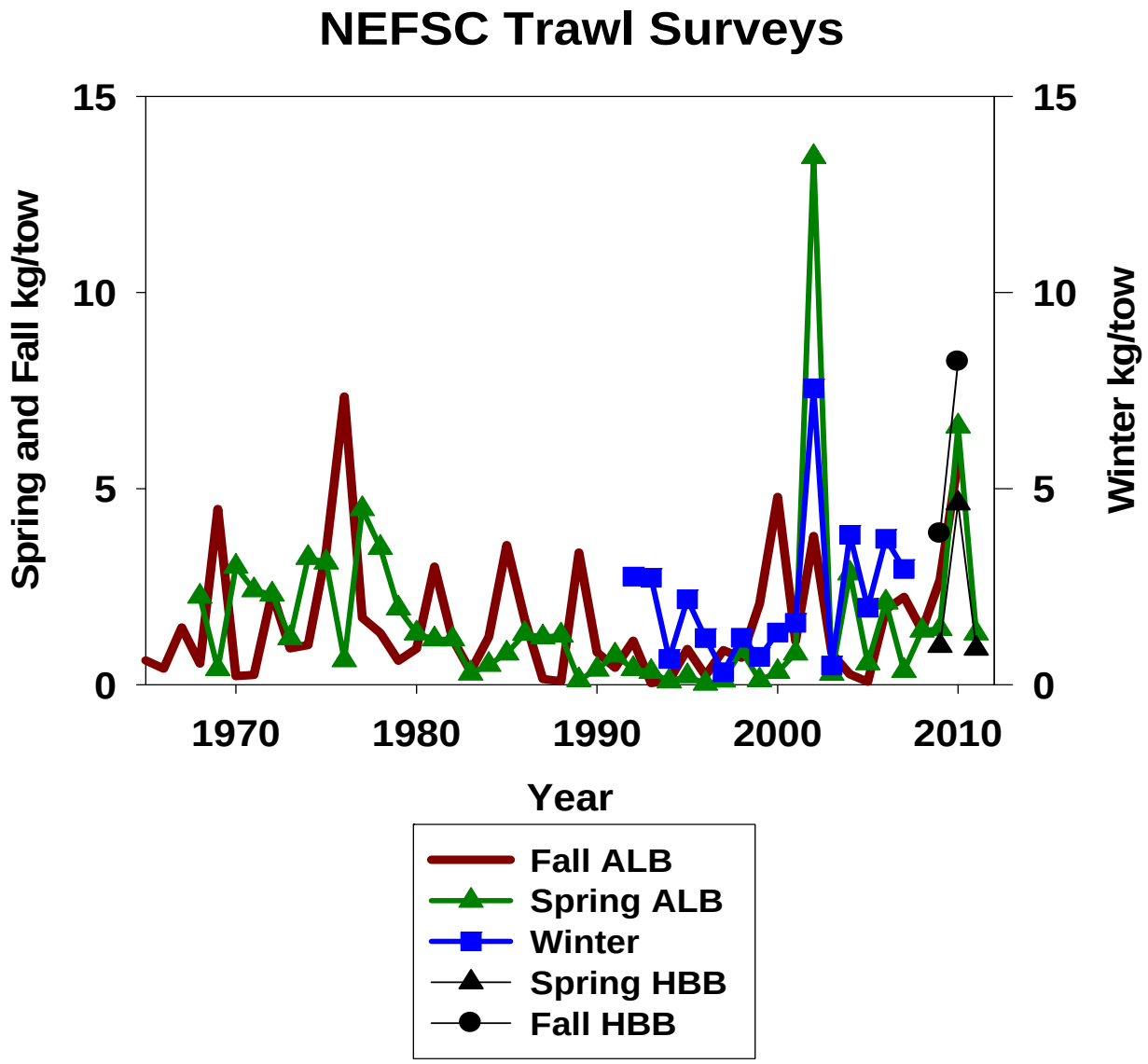


Figure 6. NEFSC Winter, Spring and Fall biomass indices for scup, including FSV *Henry B. Bigelow* (HBB) indices and FSV *Albatross IV* (ALB) equivalents.

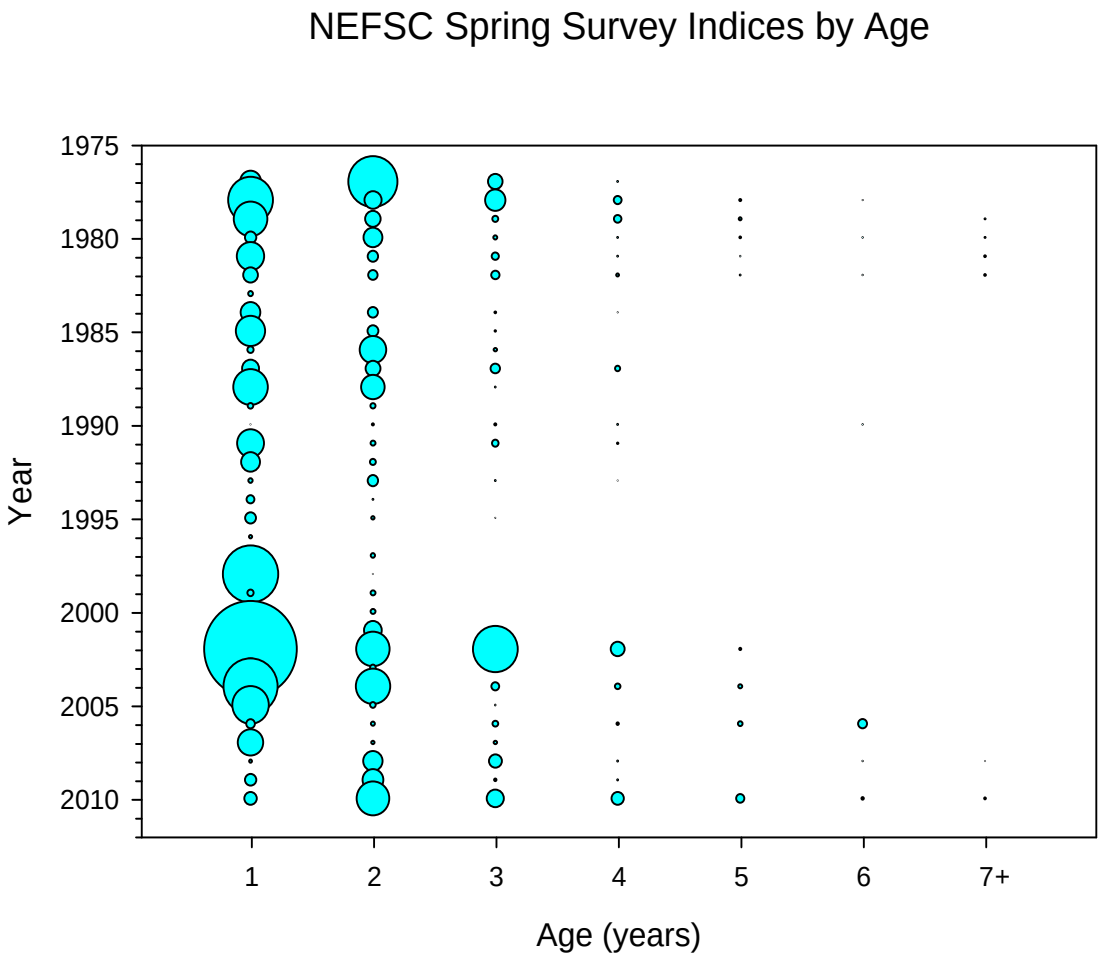


Figure 7. NEFSC Spring survey indices by age for scup.

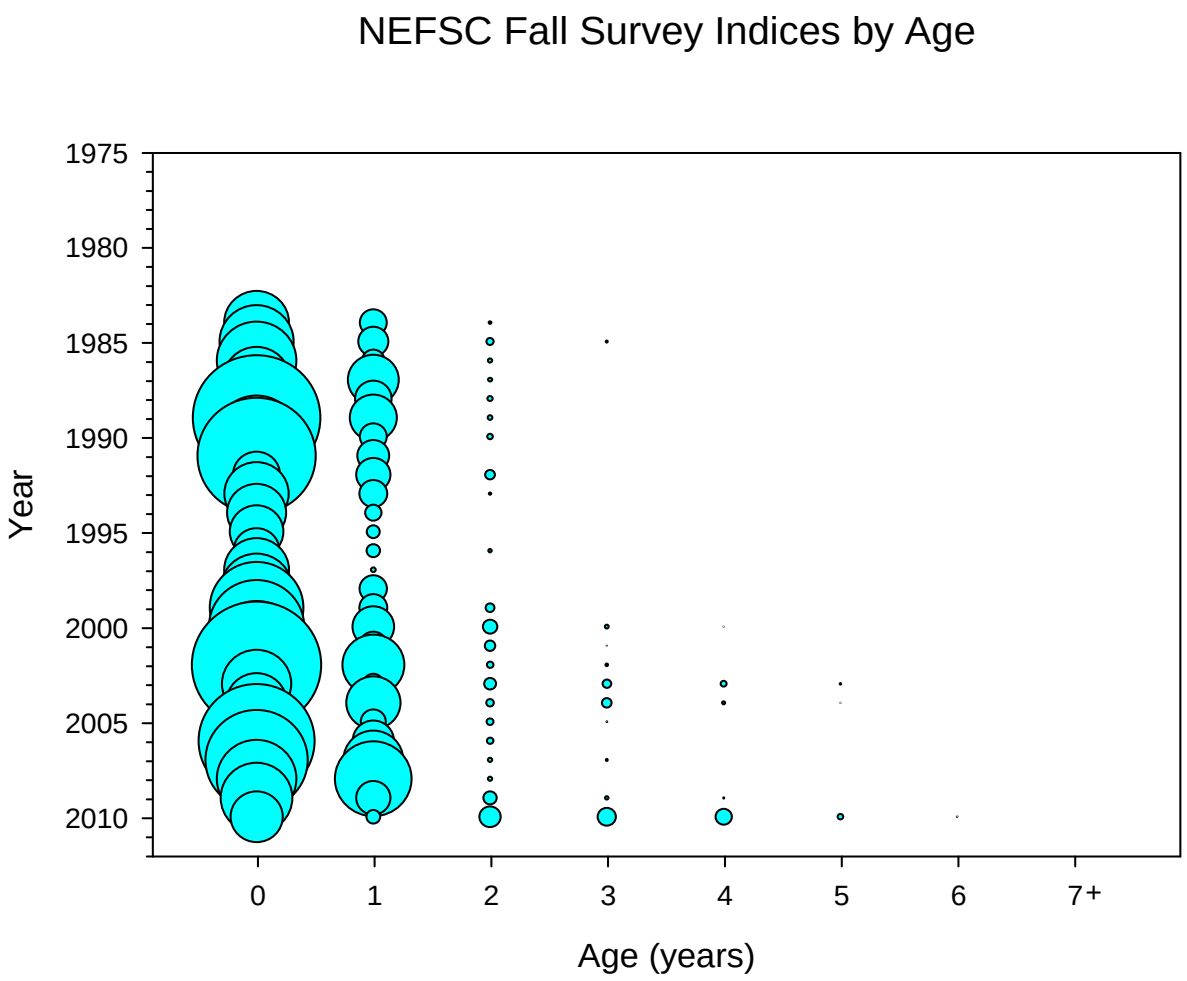


Figure 8. NEFSC Fall survey indices by age for scup.

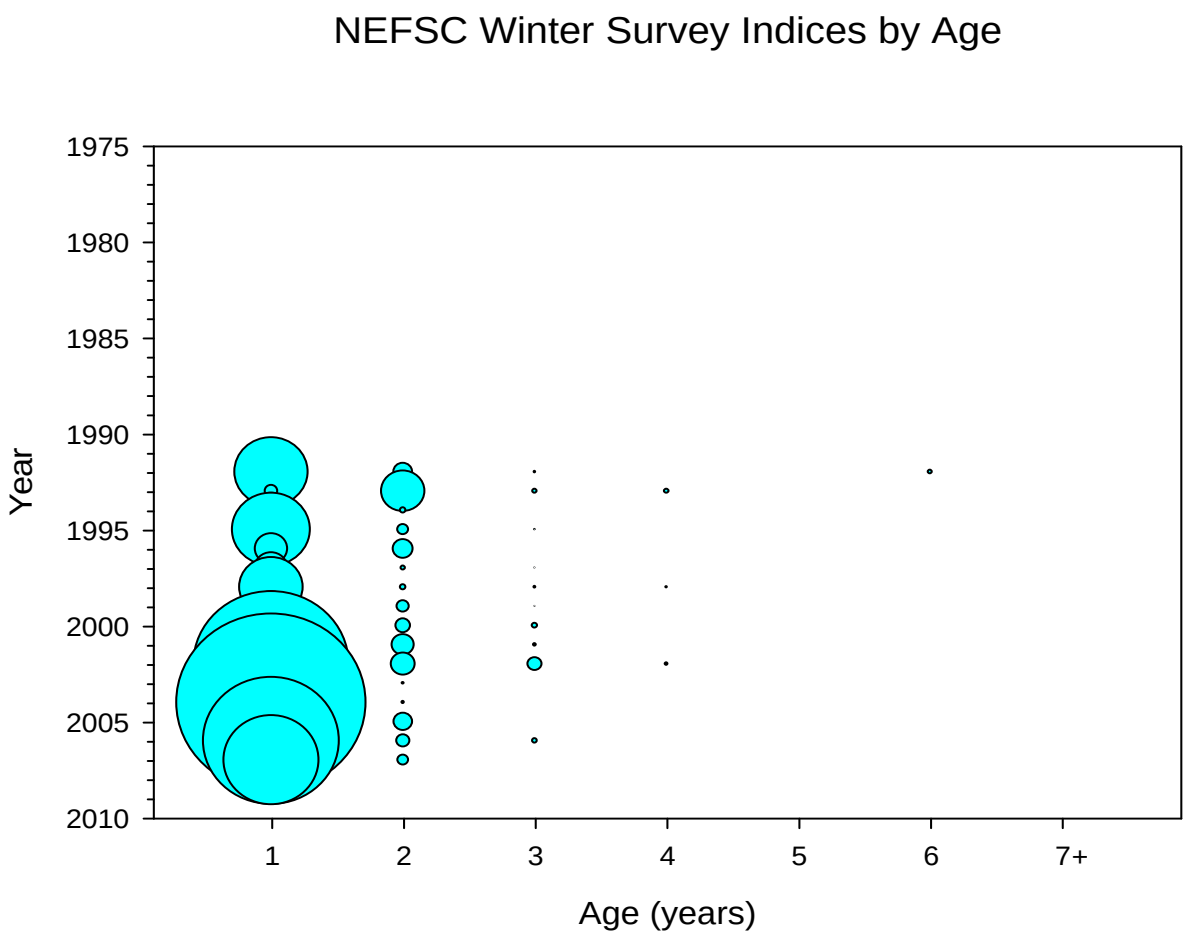


Figure 9. NEFSC Winter survey indices by age for scup.

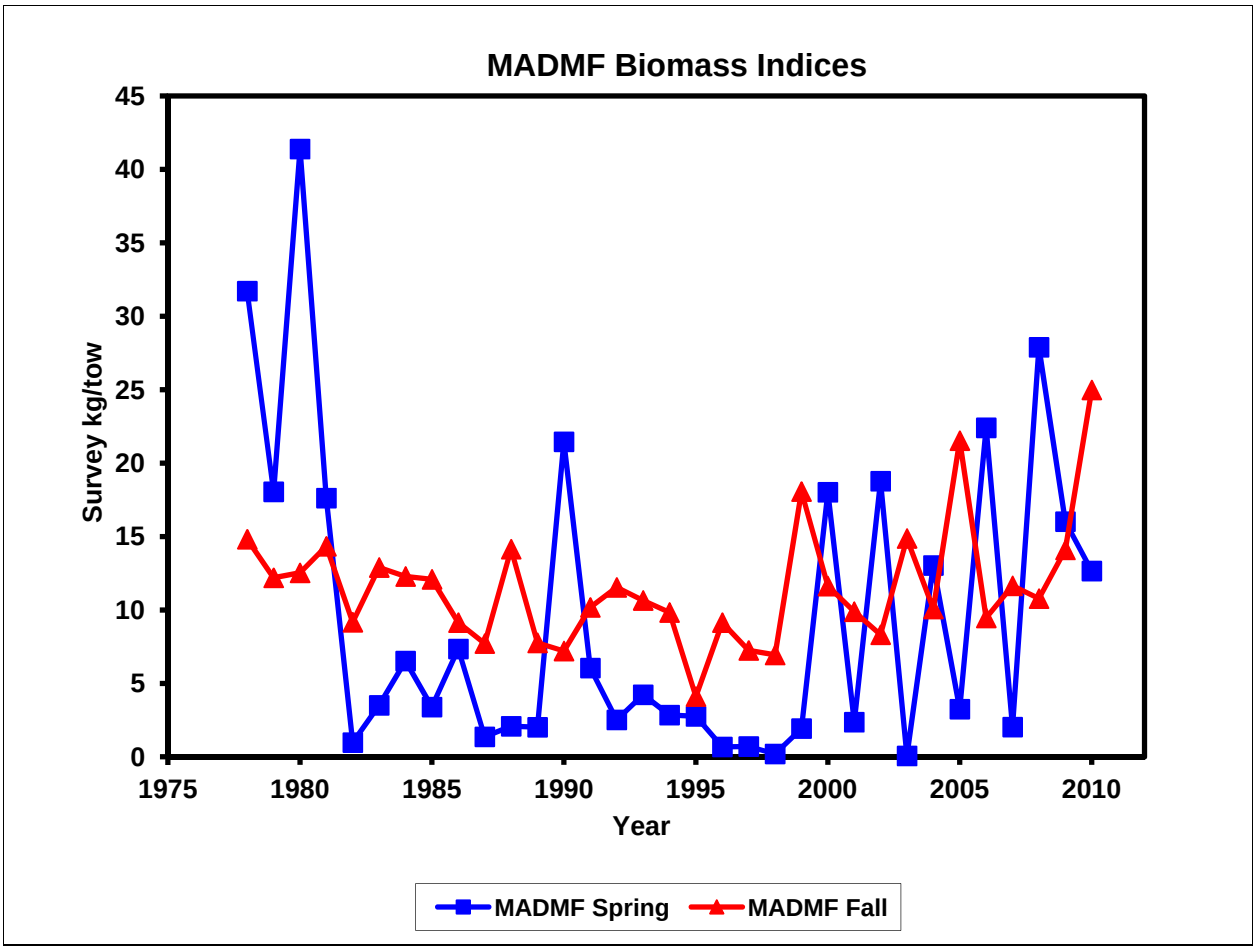


Figure 10. MADMF Spring and Fall survey aggregate biomass indices.

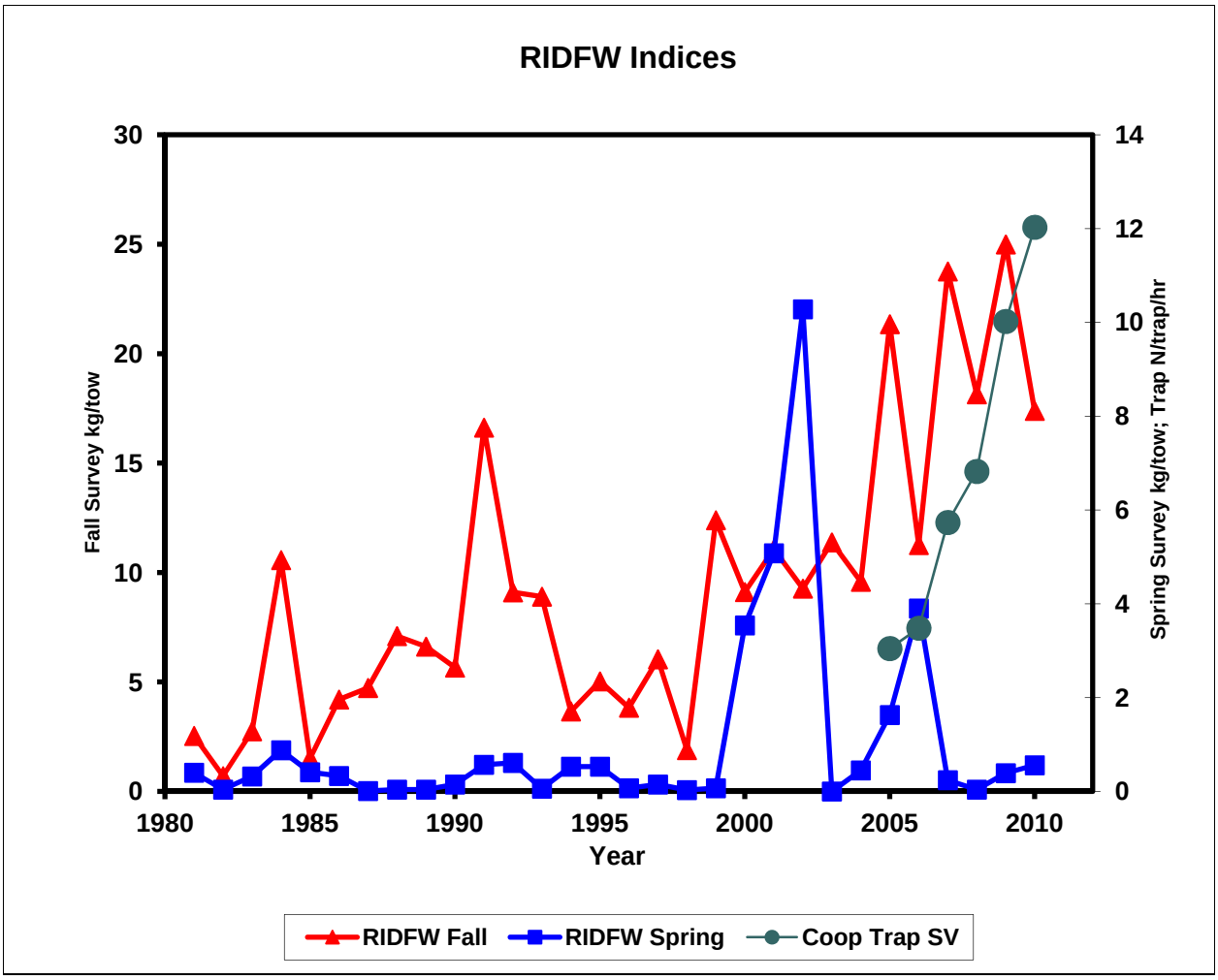


Figure 11. RIDFW Spring and Fall survey aggregate biomass indices.

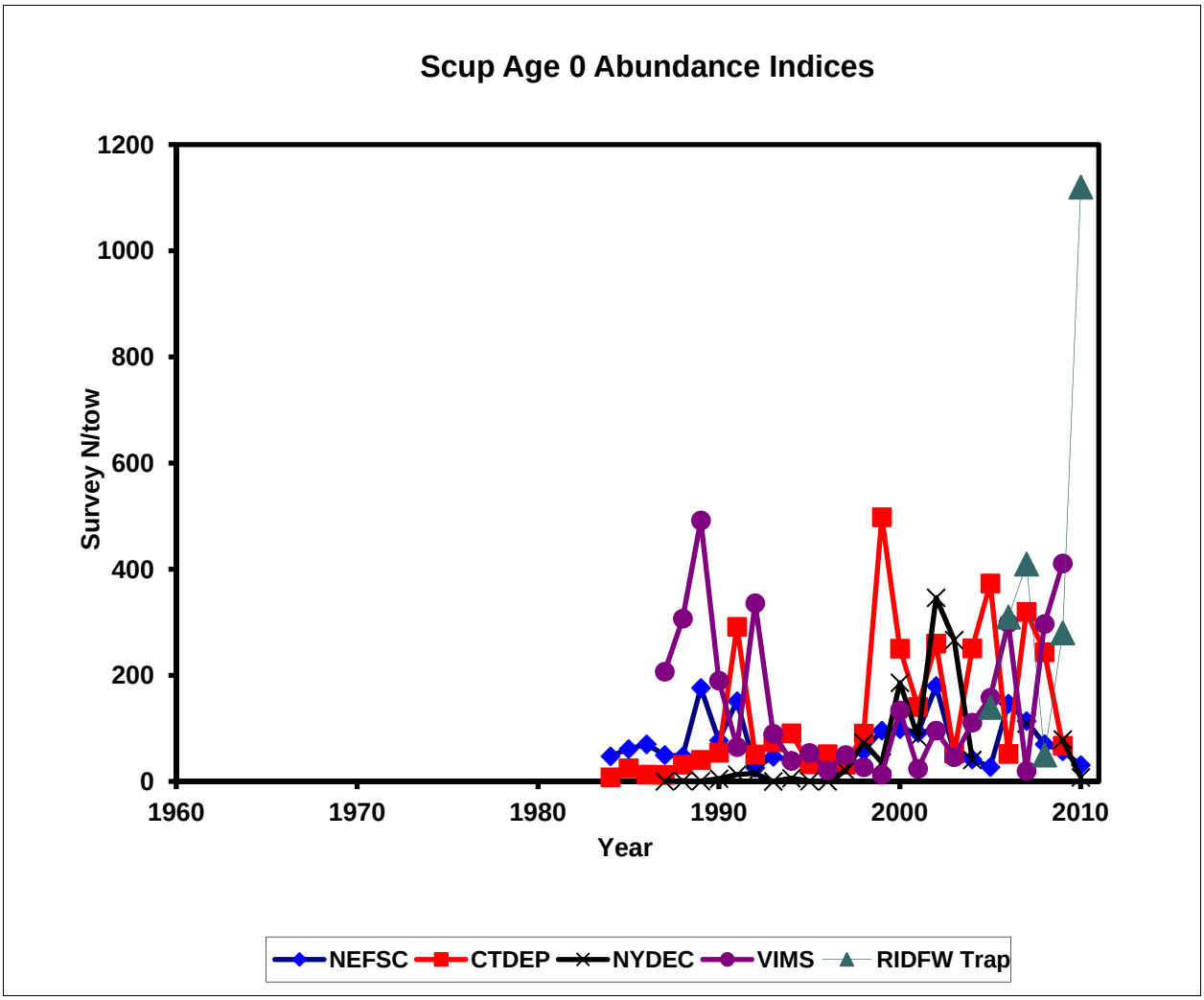


Figure 12. Research survey recruitment indices (age 0 abundance).

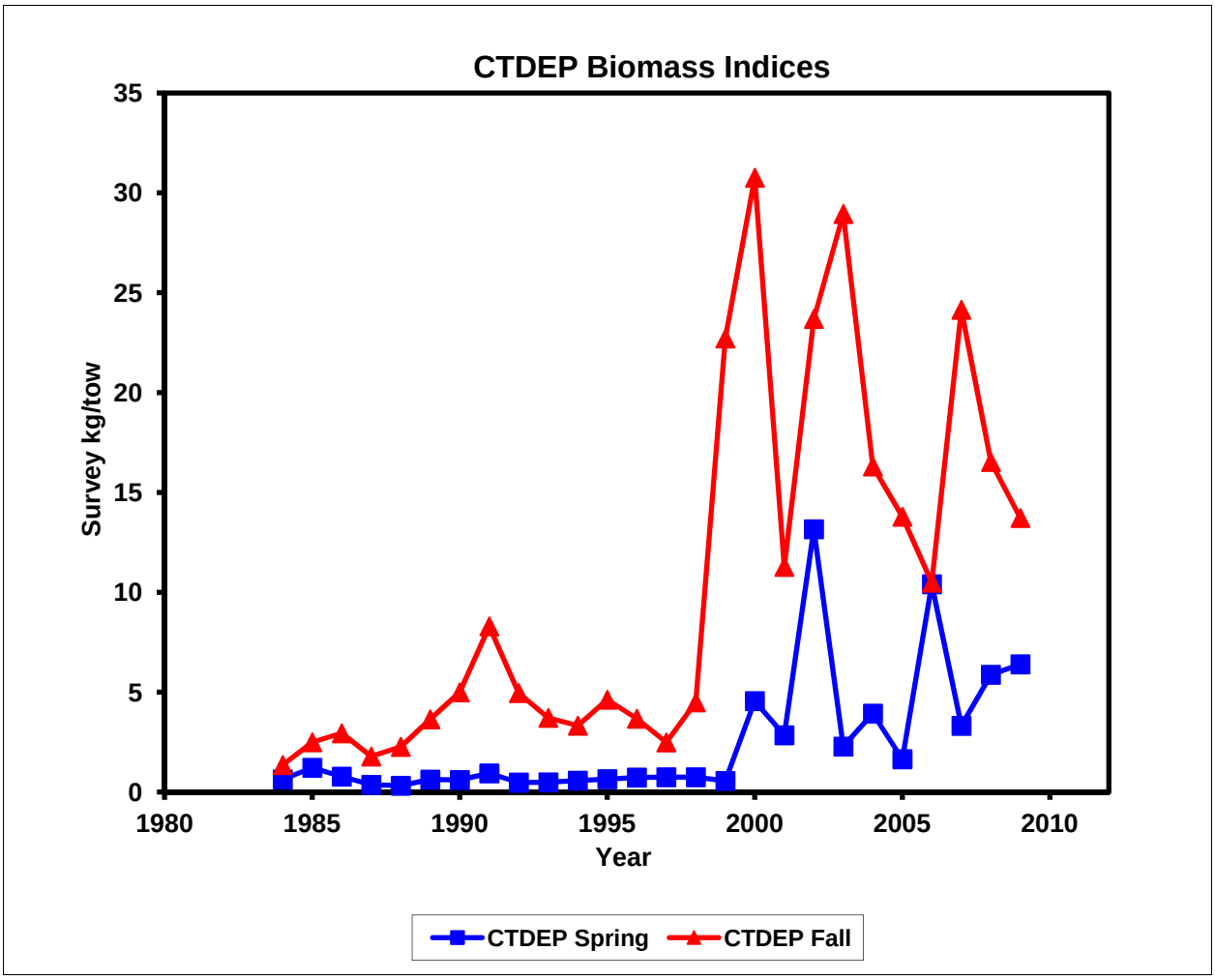


Figure 13. CTDEP Spring and Fall survey aggregate biomass indices.

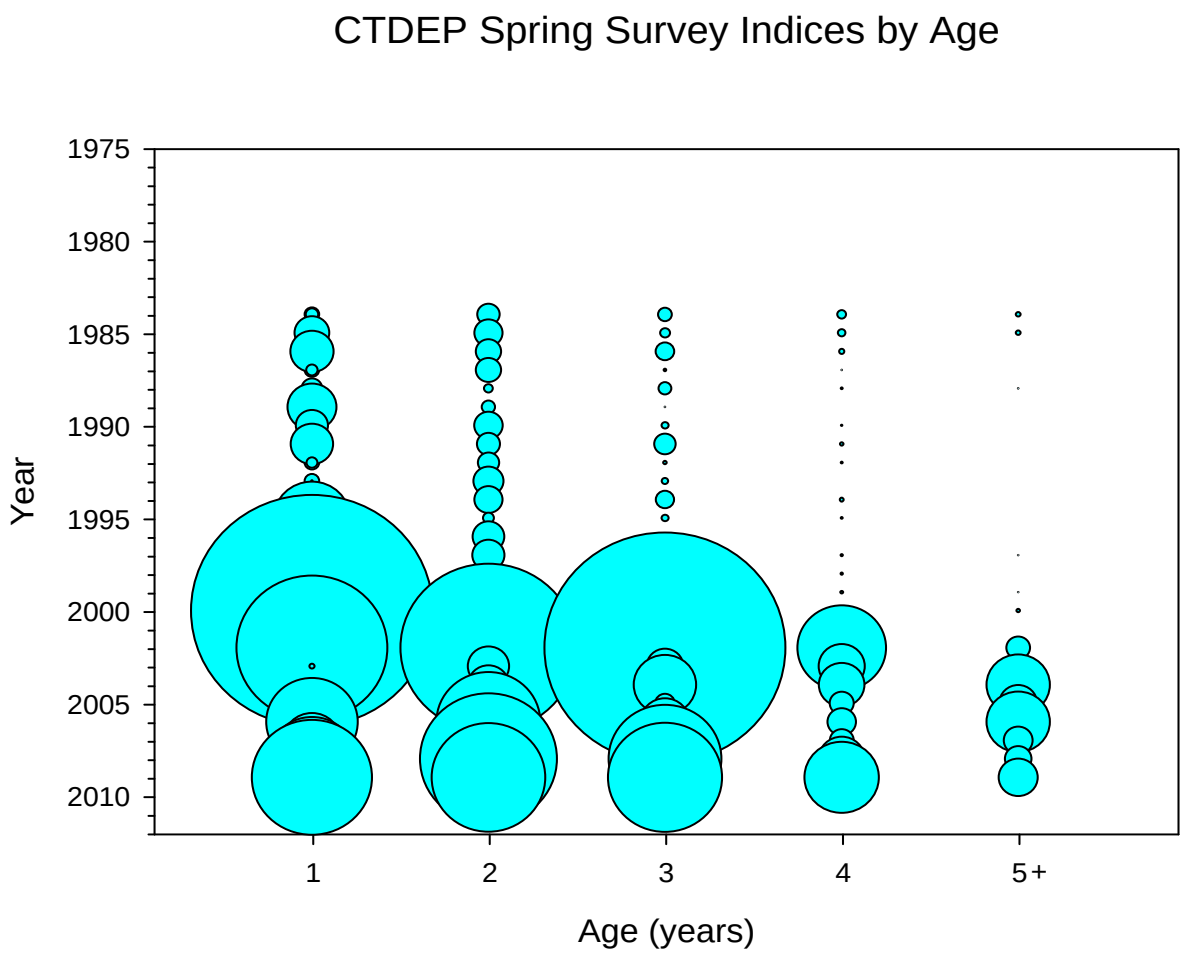


Figure 14. CTDEP Spring survey indices by age for scup.

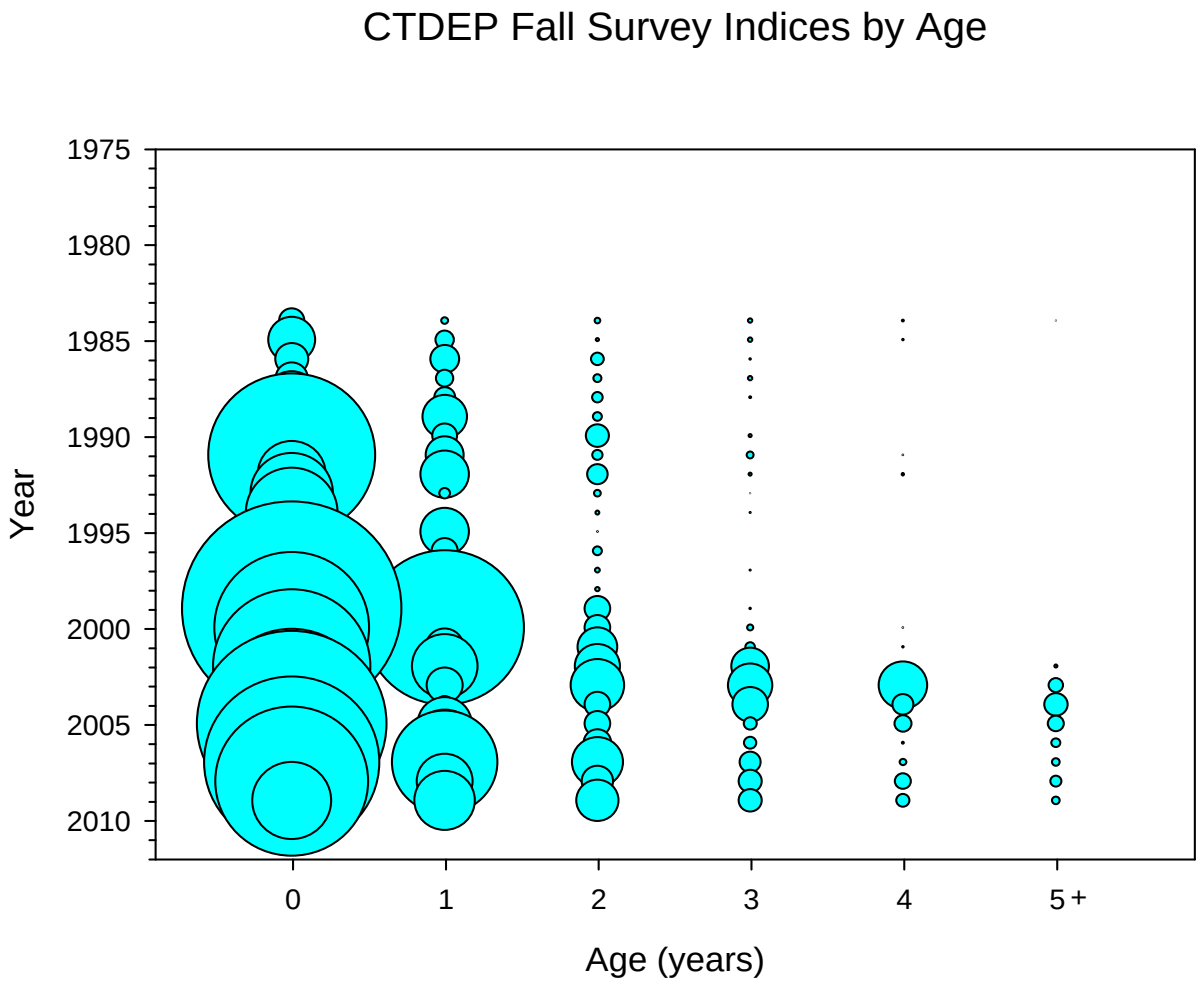


Figure 15. CTDEP Fall survey indices by age for scup.

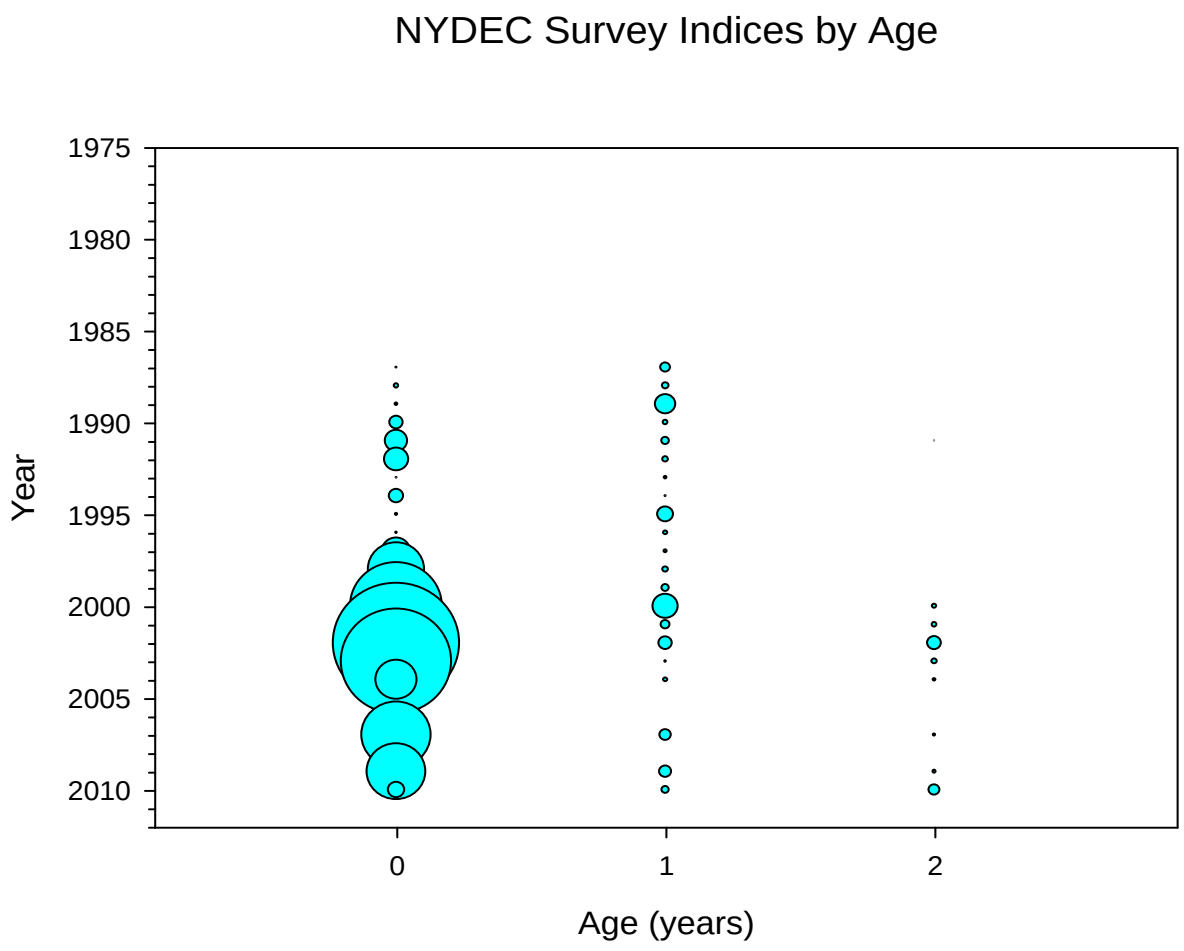


Figure 16. NYDEC survey indices by age for scup.

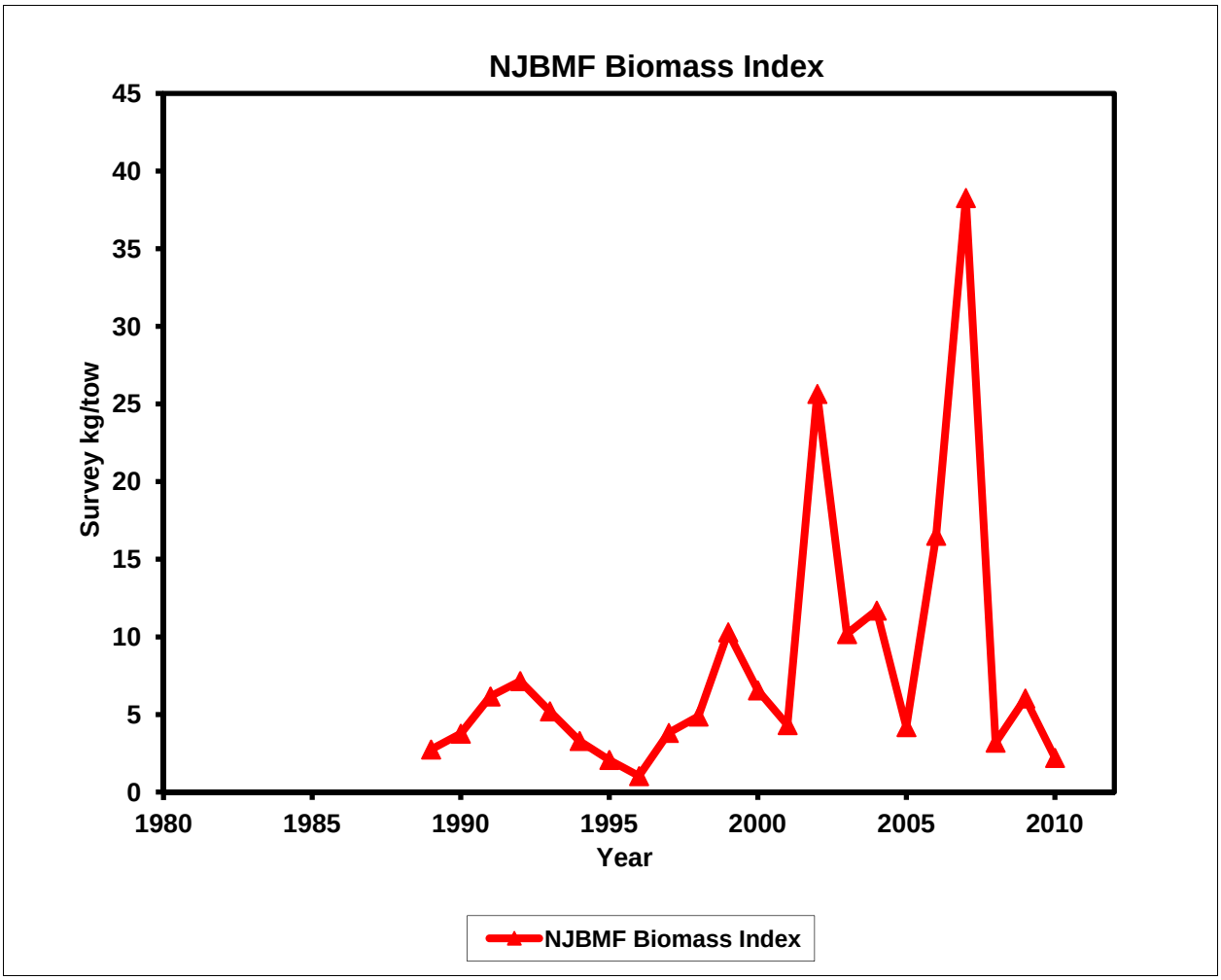


Figure 17. NJBMF survey biomass index.

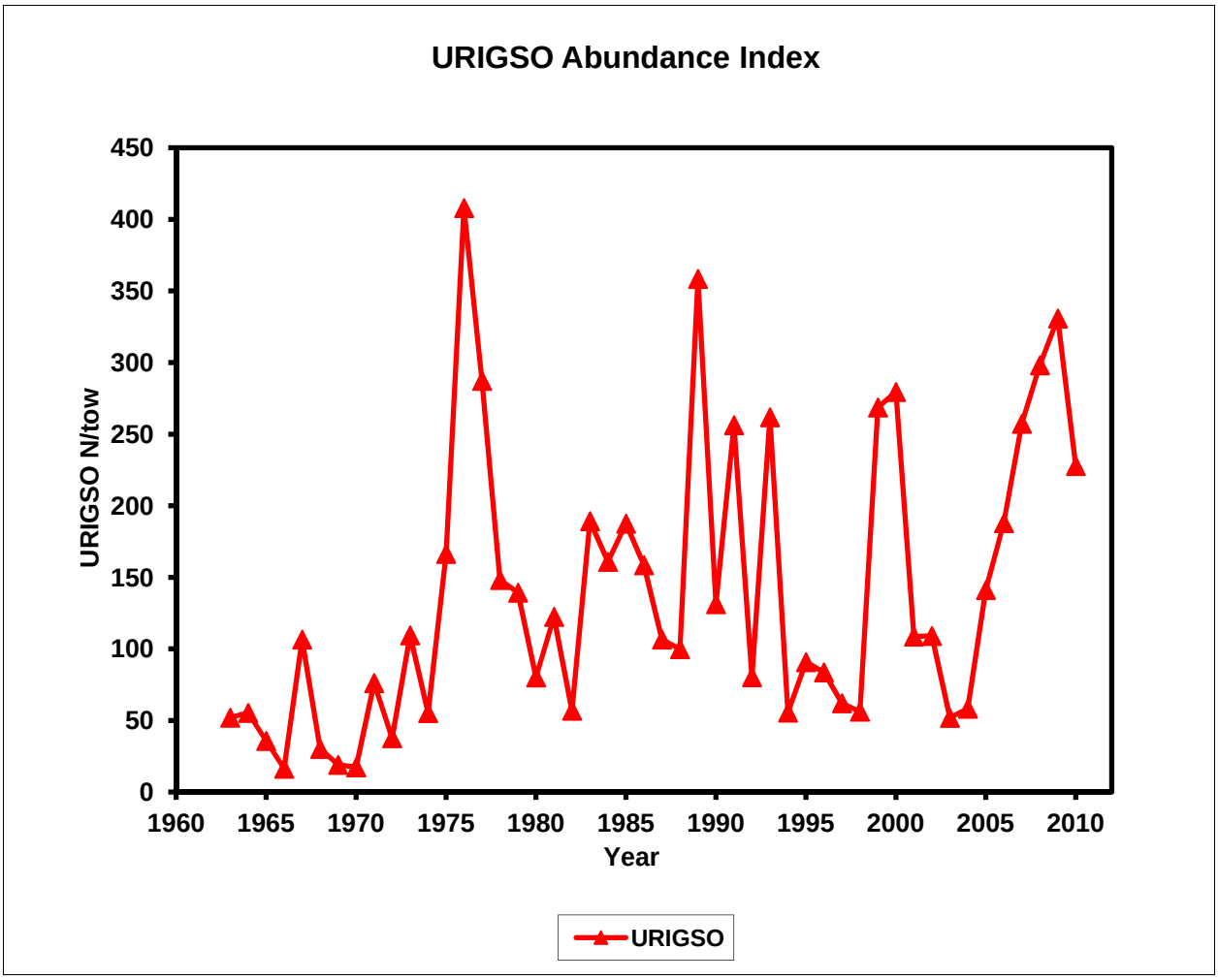


Figure 18. URIGSO survey aggregate abundance index.

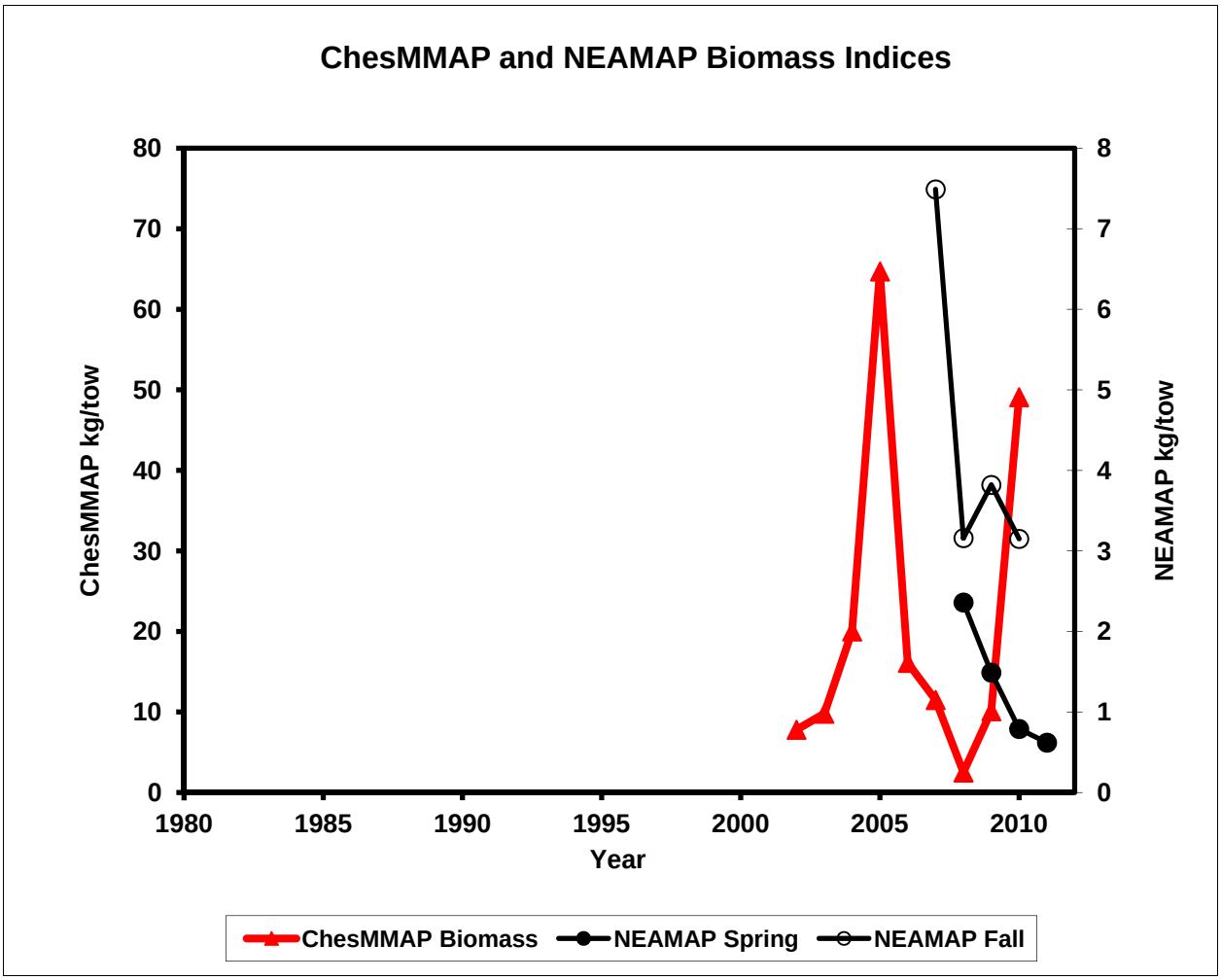


Figure 19. VIMS ChesMMap and NEAMAP Spring and Fall biomass indices.

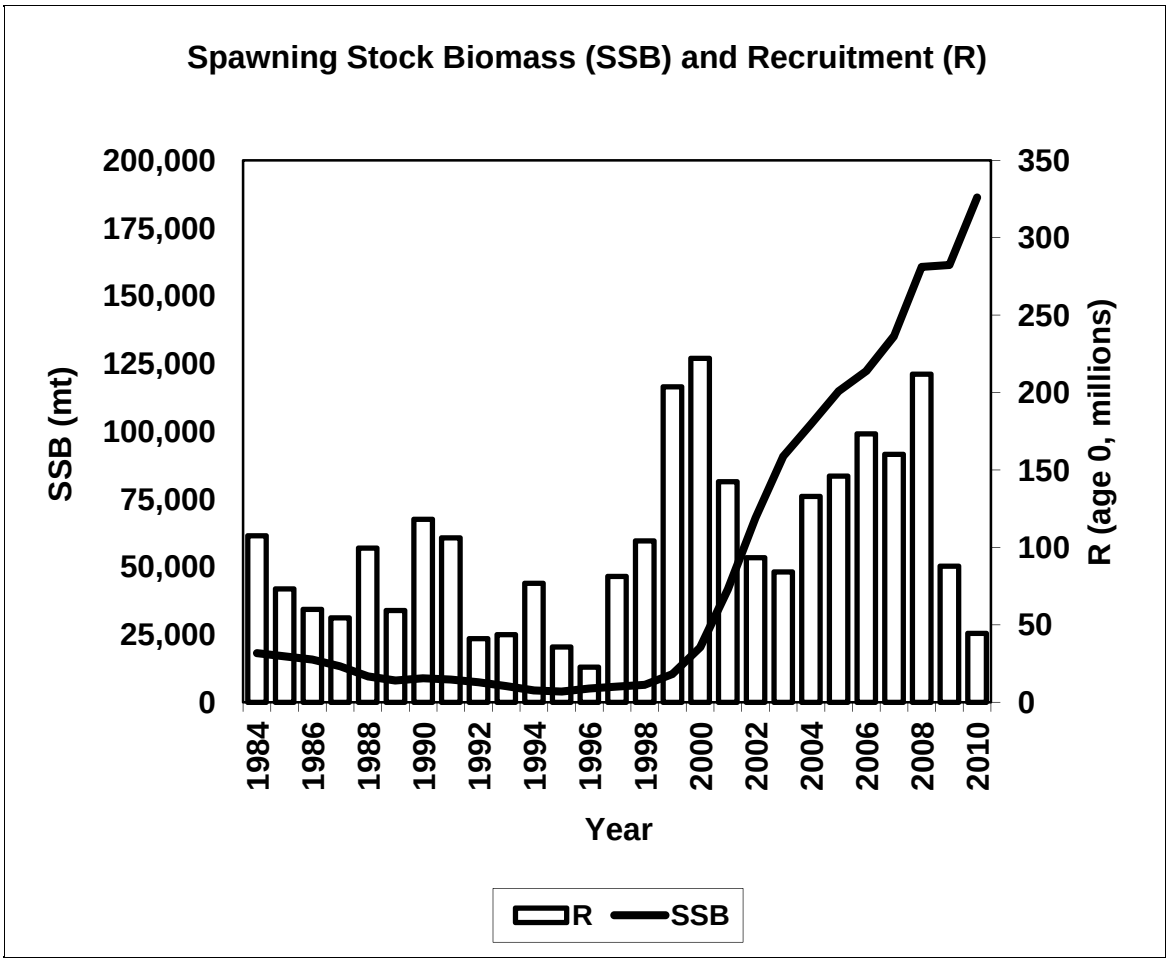


Figure 20. Trends in Spawning Stock Biomass (SSB) and Recruitment (R).

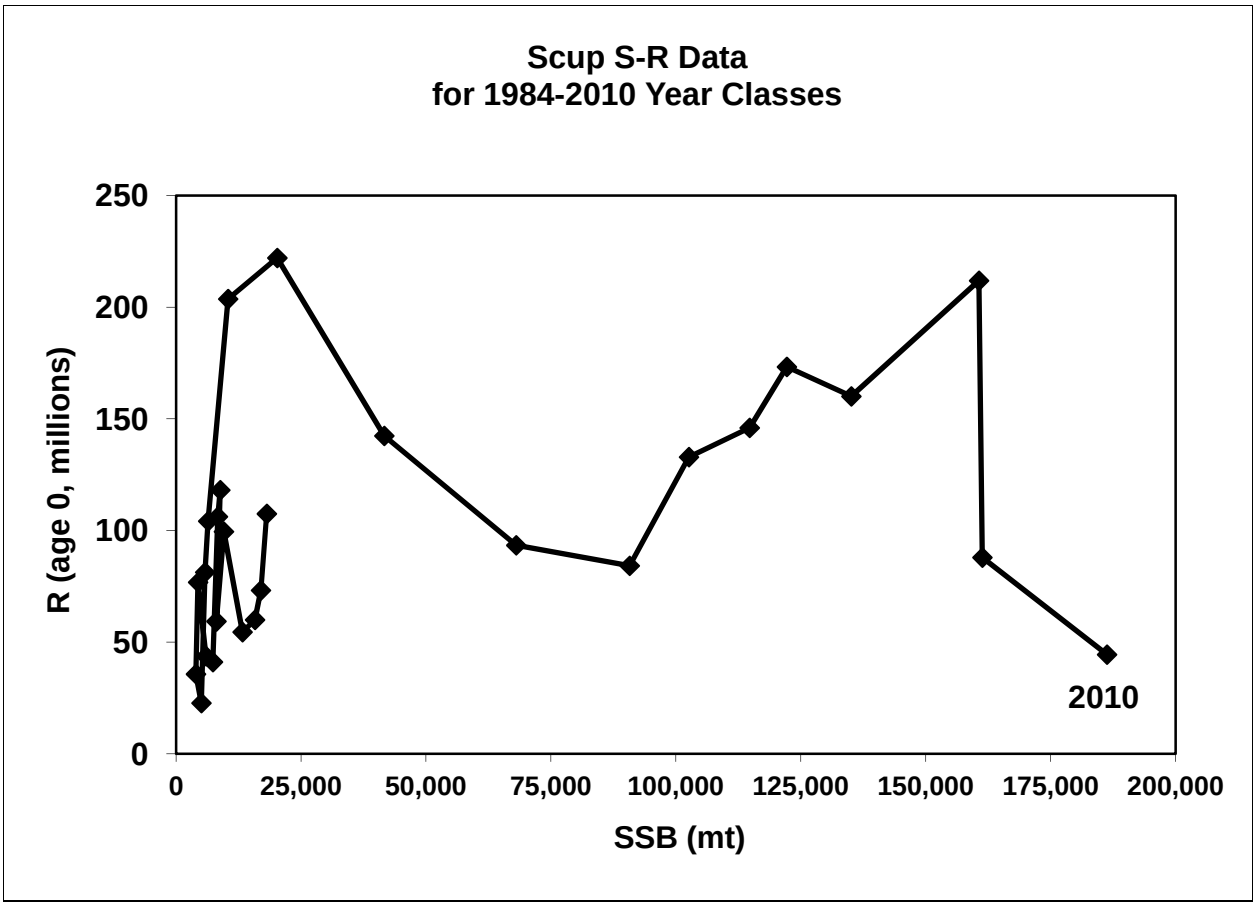


Figure 21. Spawning Stock Biomass (SSB) and Recruitment (R) scatterplot for scup.

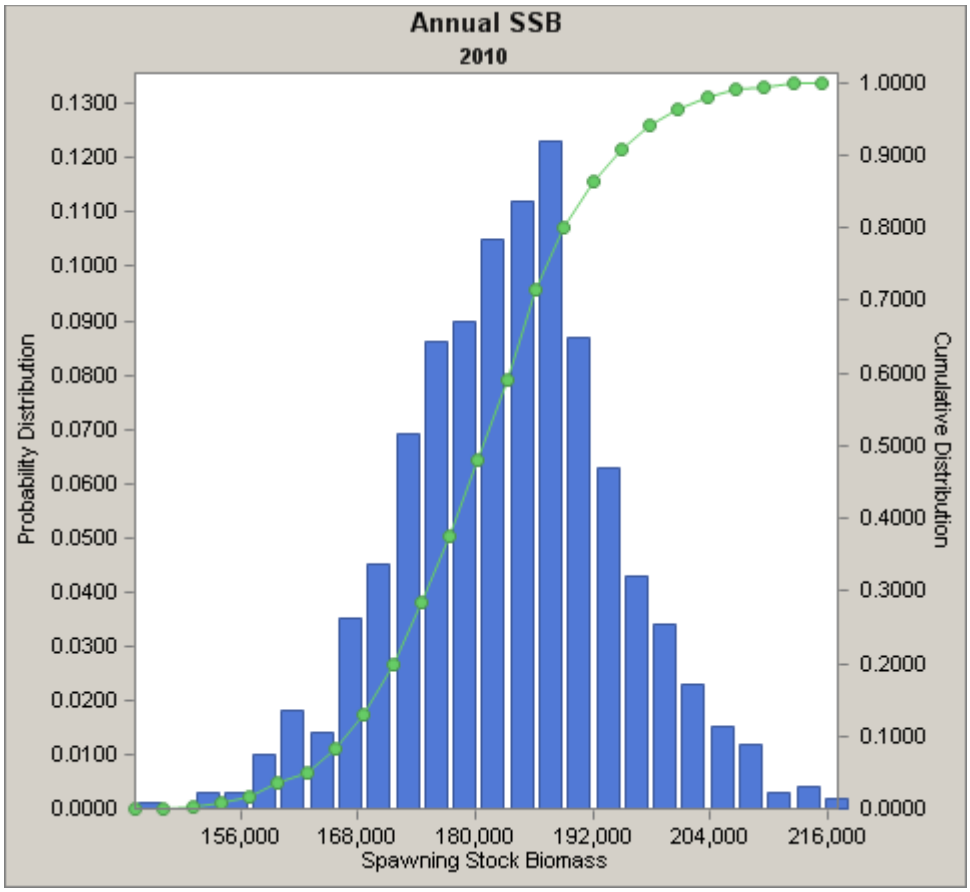


Figure 22. MCMC distribution plot for the 2010 estimate of SSB.

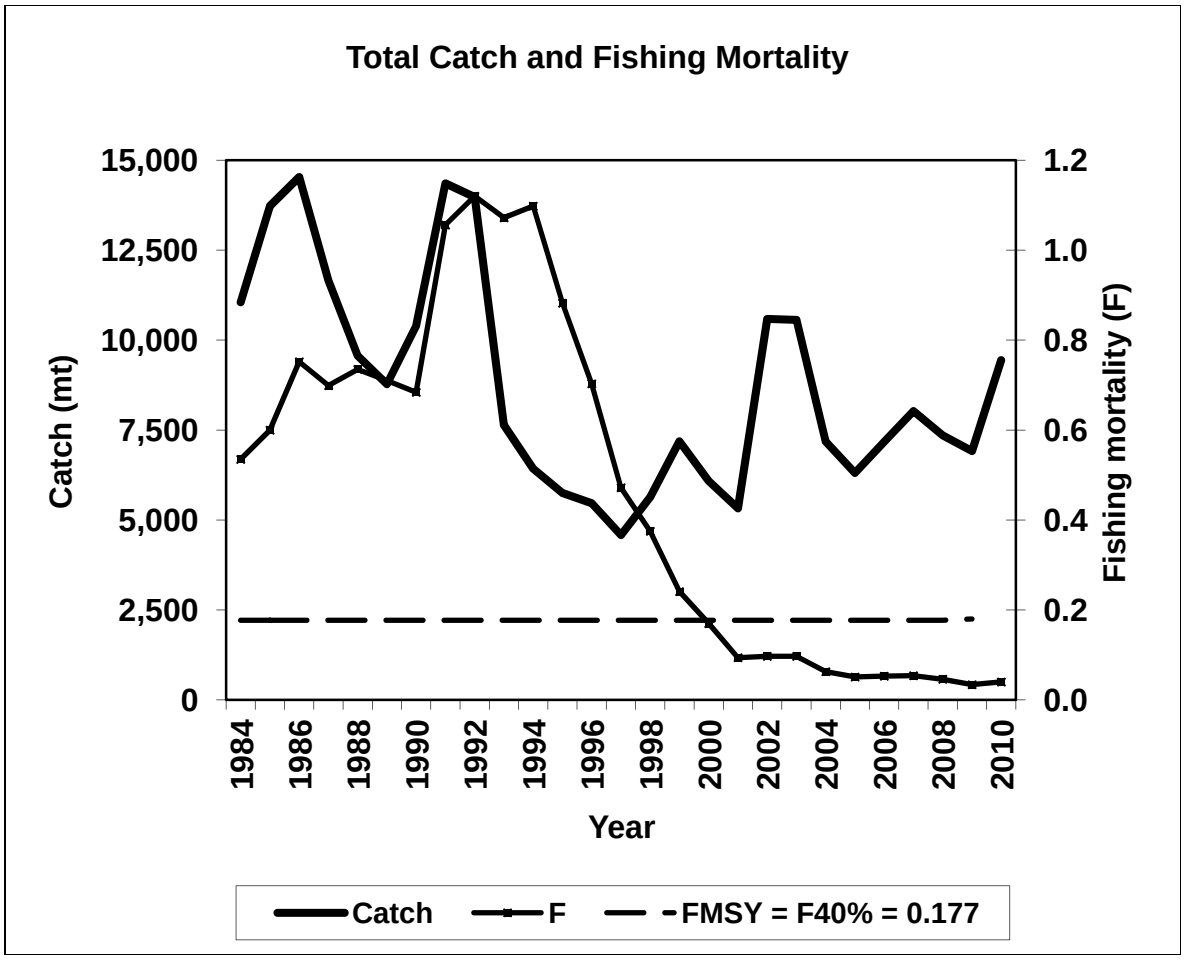


Figure 23. Trends in Total Fishery Catch (Catch) and Fishing Mortality (F, ages 2-7+). The dashed horizontal line is the F40% = 0.177 proxy for FMSY.

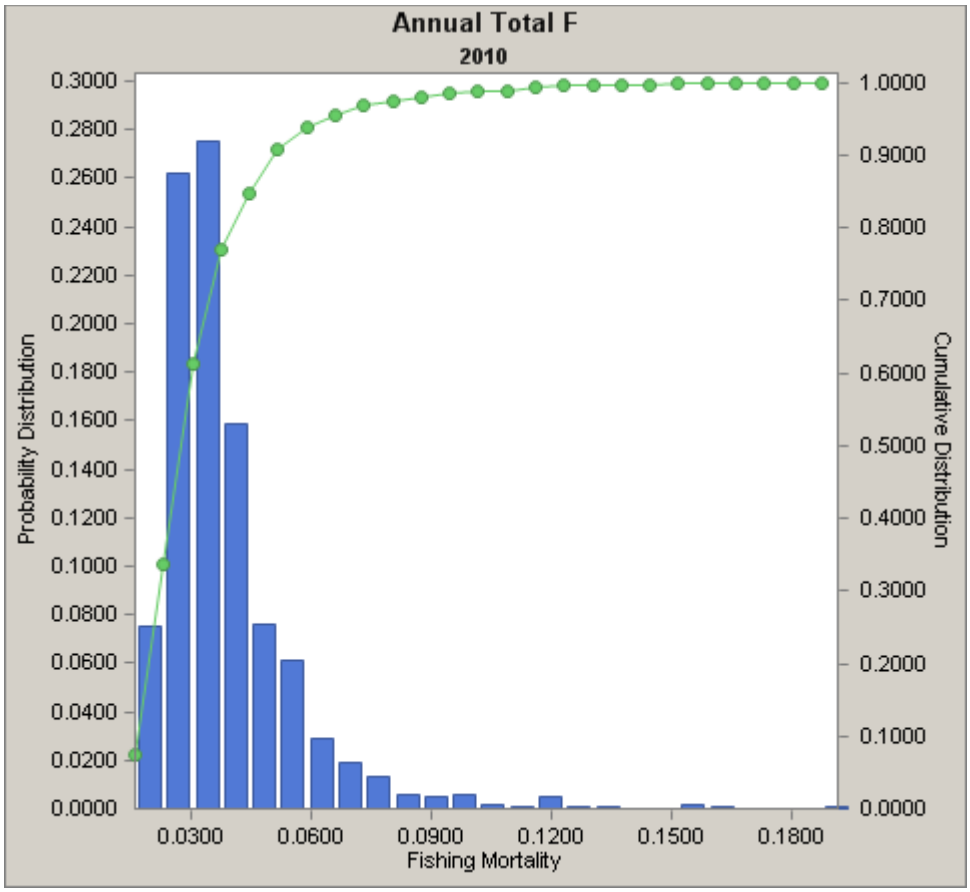


Figure 24. MCMC distribution plot for the 2010 estimate of fishing mortality (F).

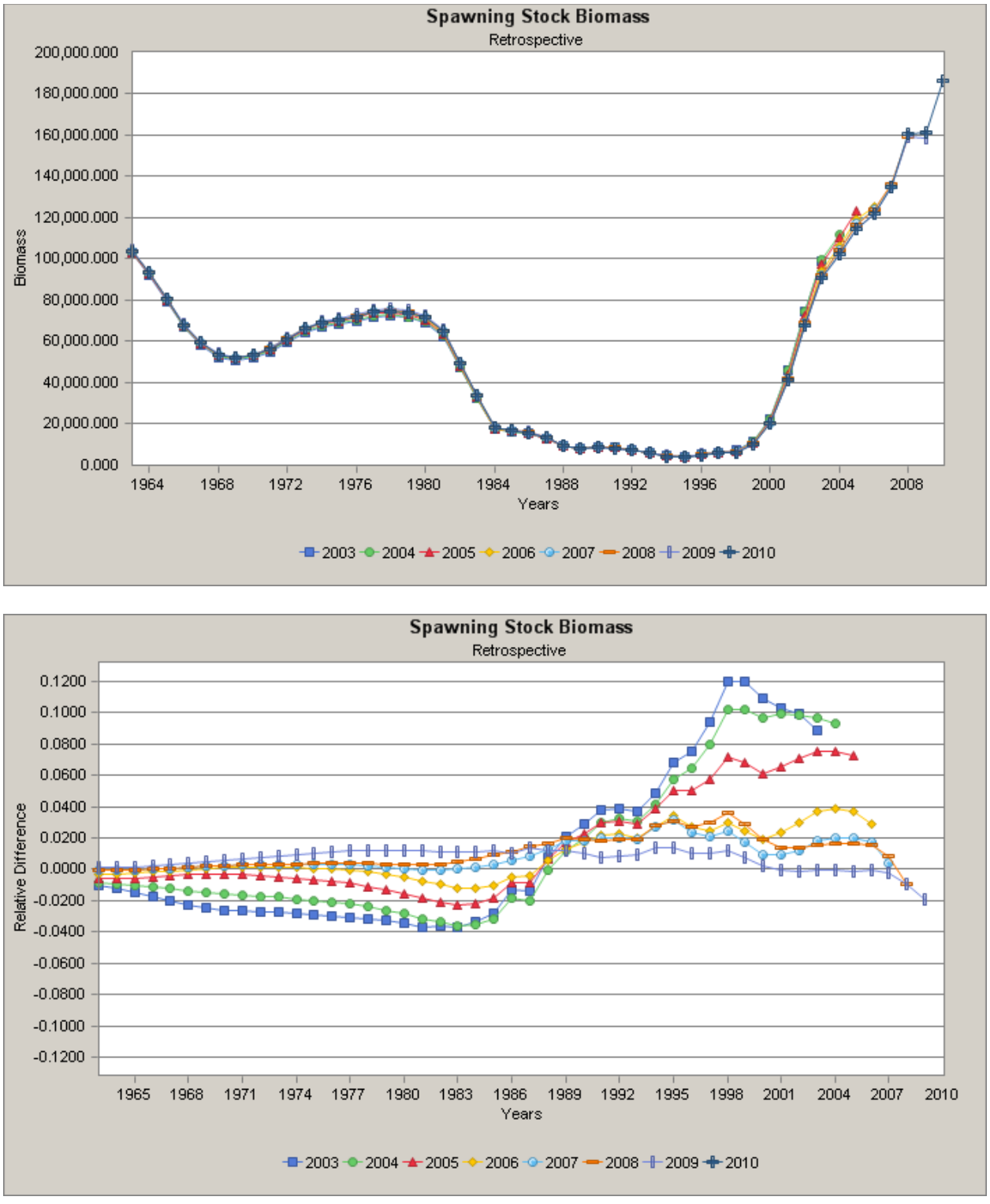
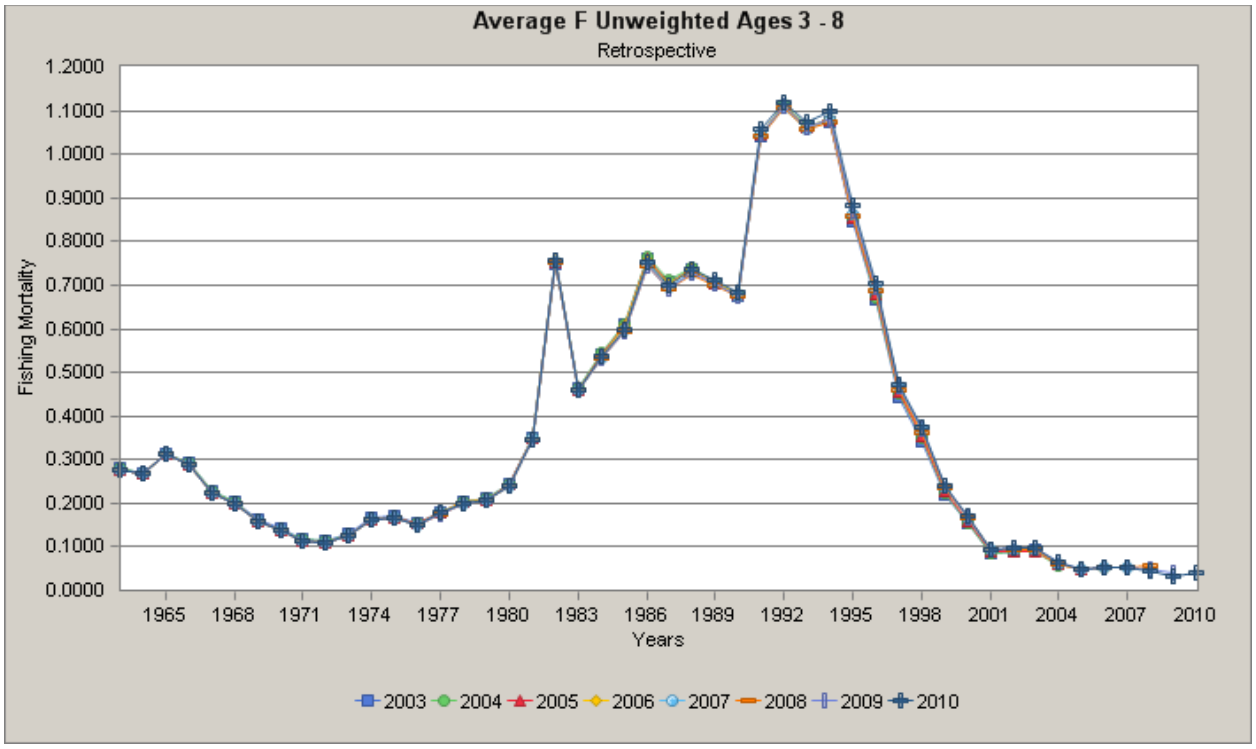


Figure 25. Retrospective analysis of the ASAP SCAA: Spawning Stock Biomass.



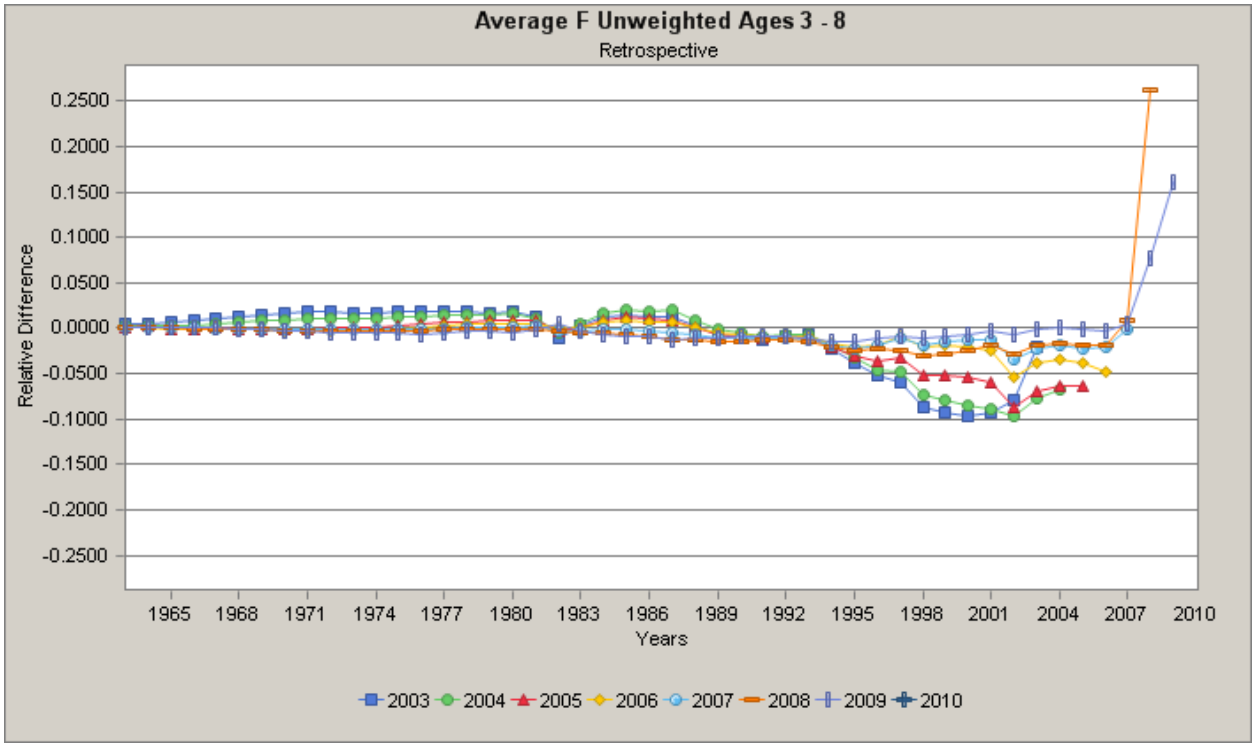


Figure 26. Retrospective analysis of the ASAP SCAA: Fishing mortality (F ages 2-7+). Note that model ages 3-8 are true ages 2-7+.

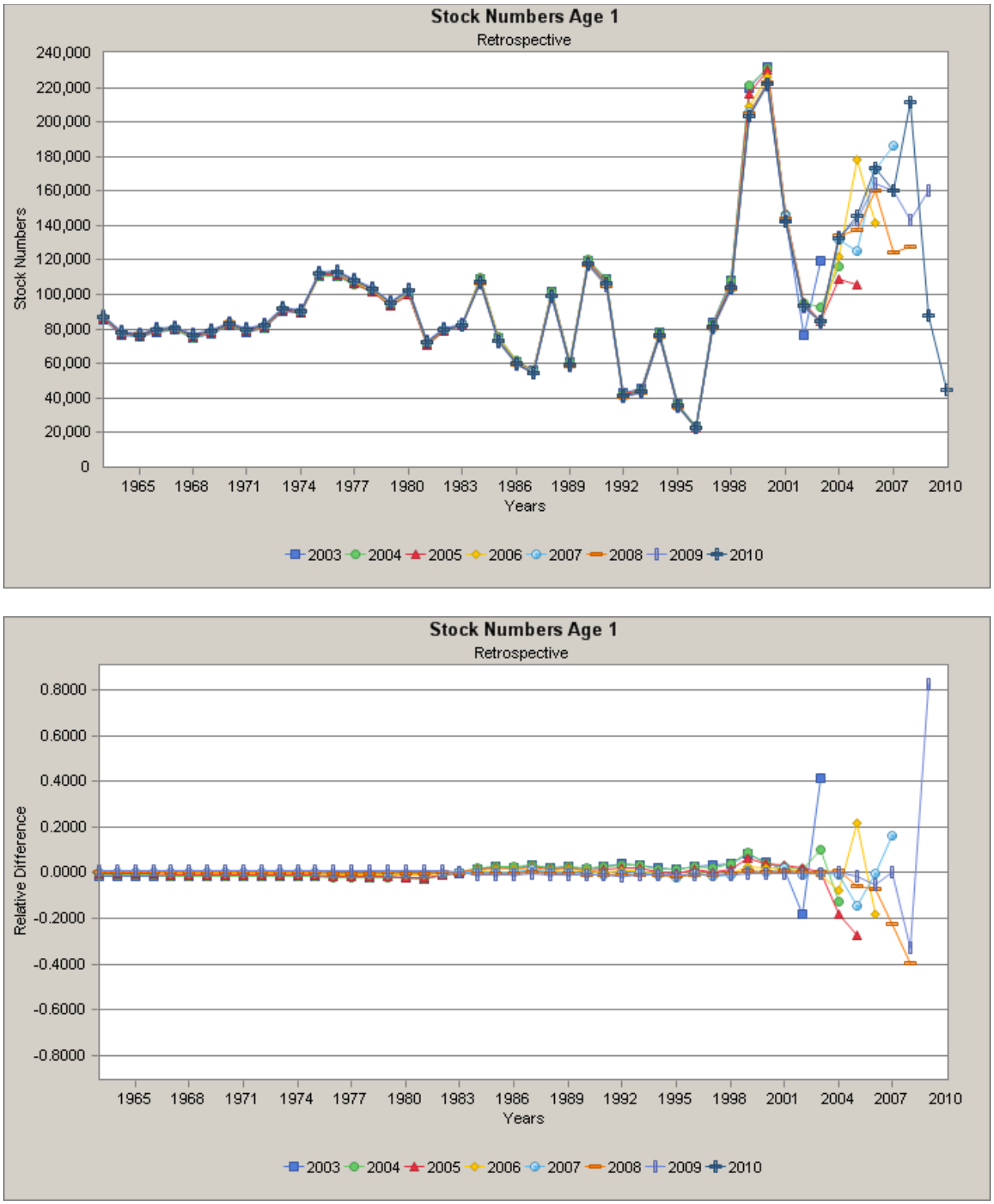


Figure 27. Retrospective analysis of the ASAP SCAA for scup: Recruitment at age 0. Note that model age 1 is true age 0.

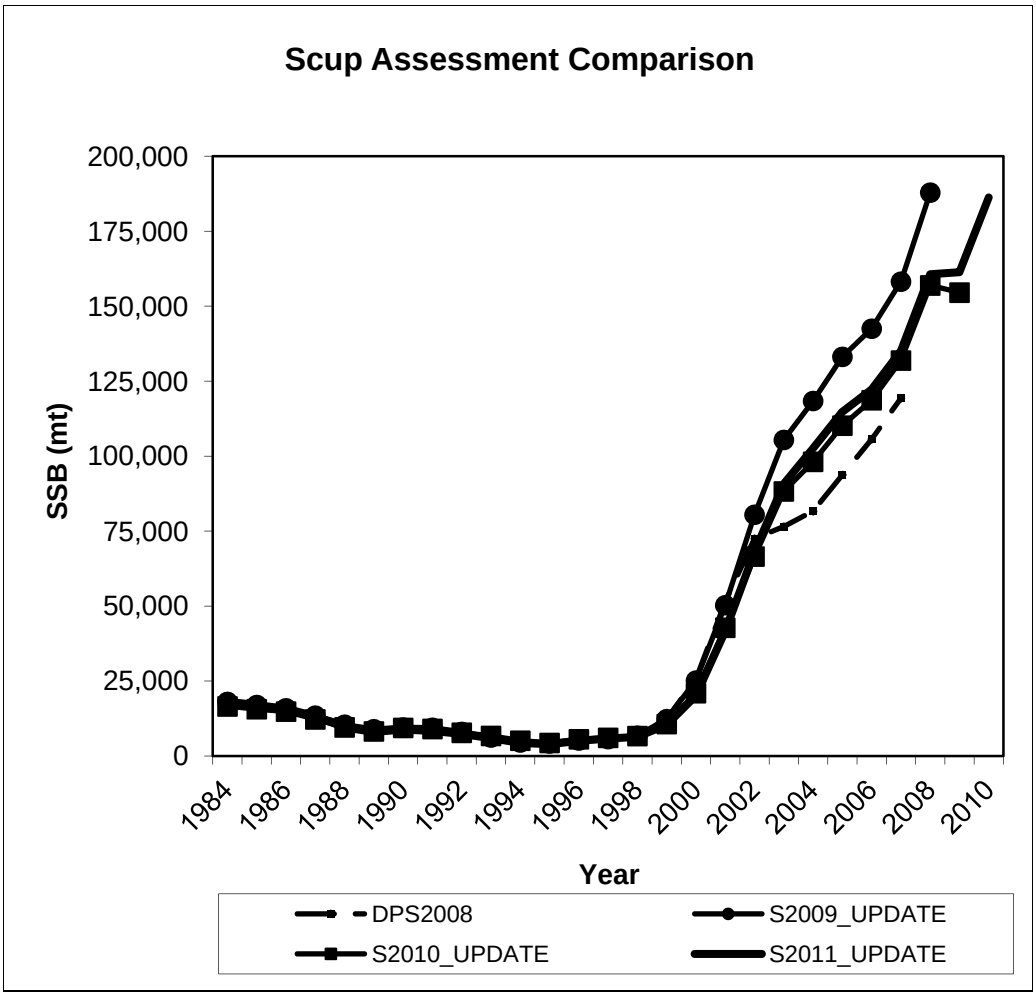


Figure 28. Comparison of the estimates of SSB from the 2008 DPS, 2009, 2010 and 2011 updated assessments.

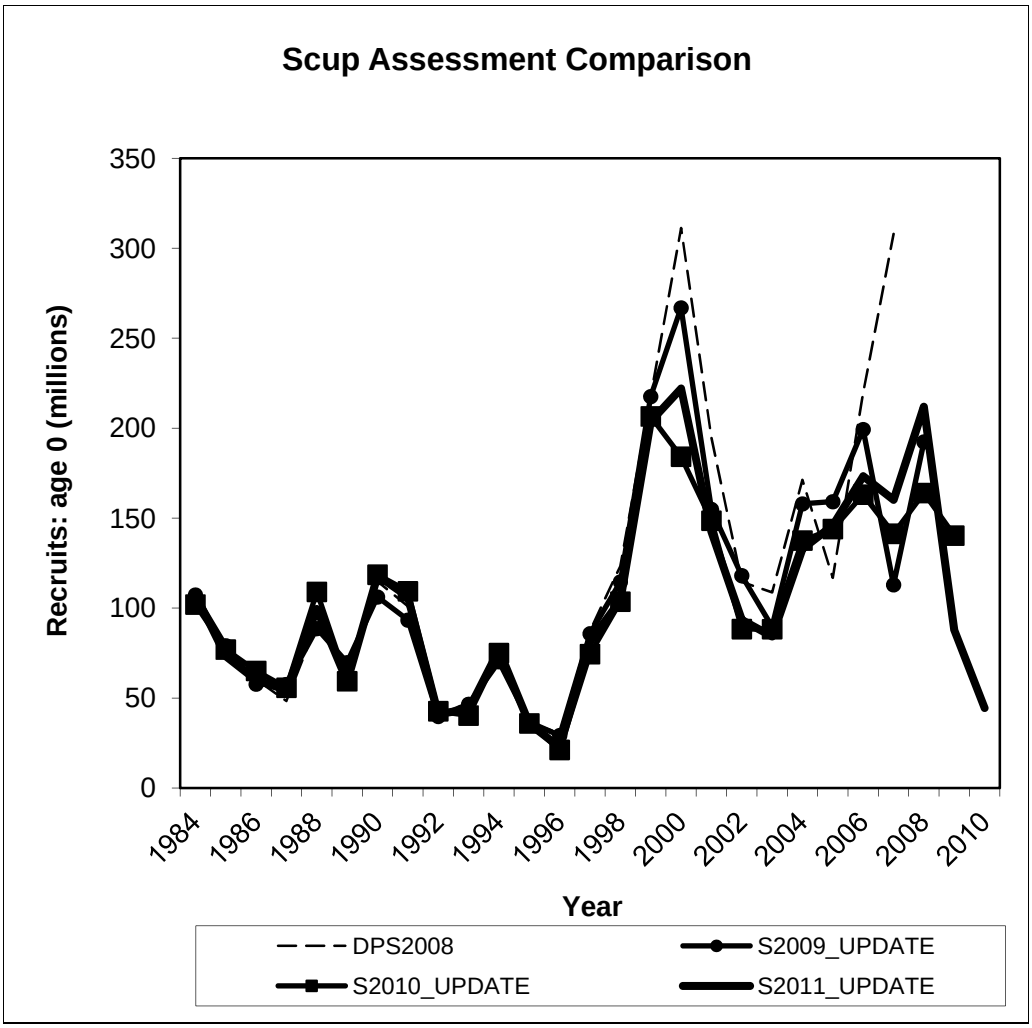


Figure 29. Comparison of the estimates of recruitment from the 2008 DPS, 2009, 2010, and 2011 updated assessments.

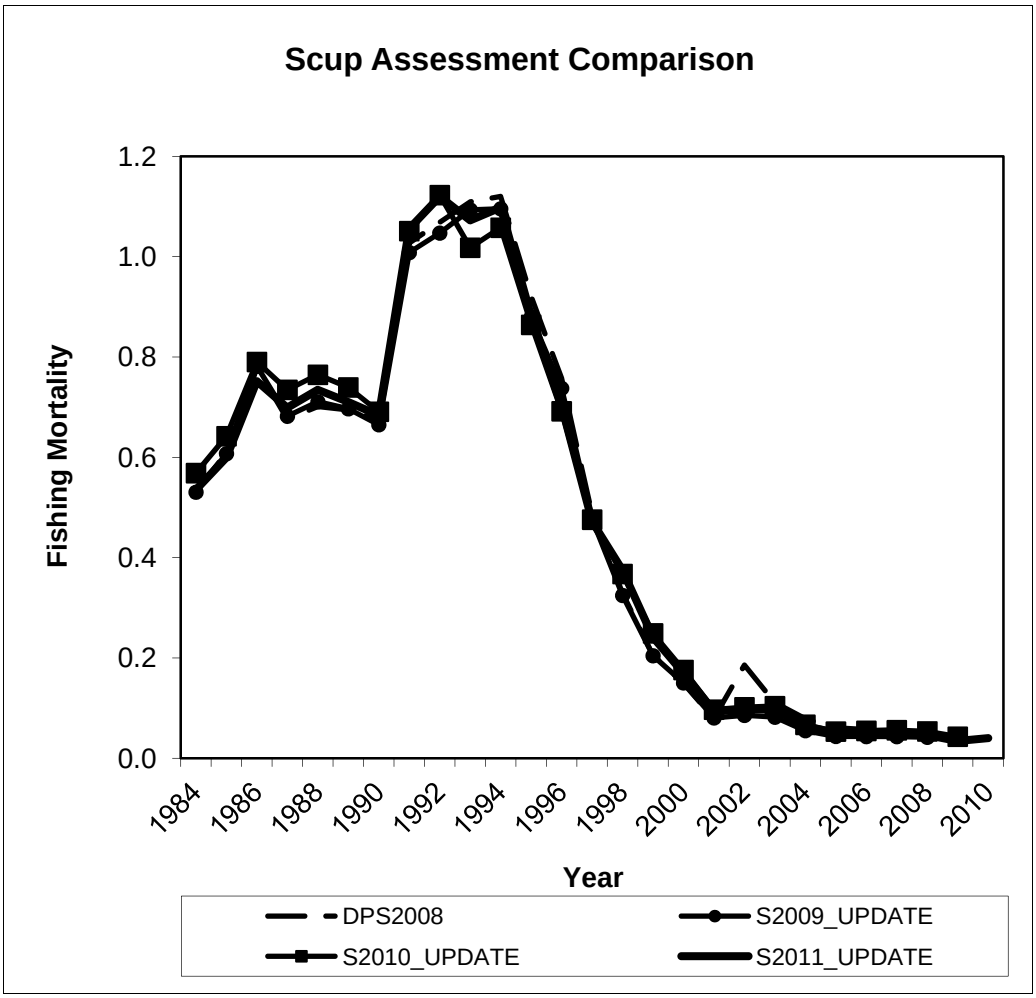


Figure 30. Comparison of the estimates of fishing mortality from the 2008 DPS, 2009, 2010, and 2011 updated assessments.

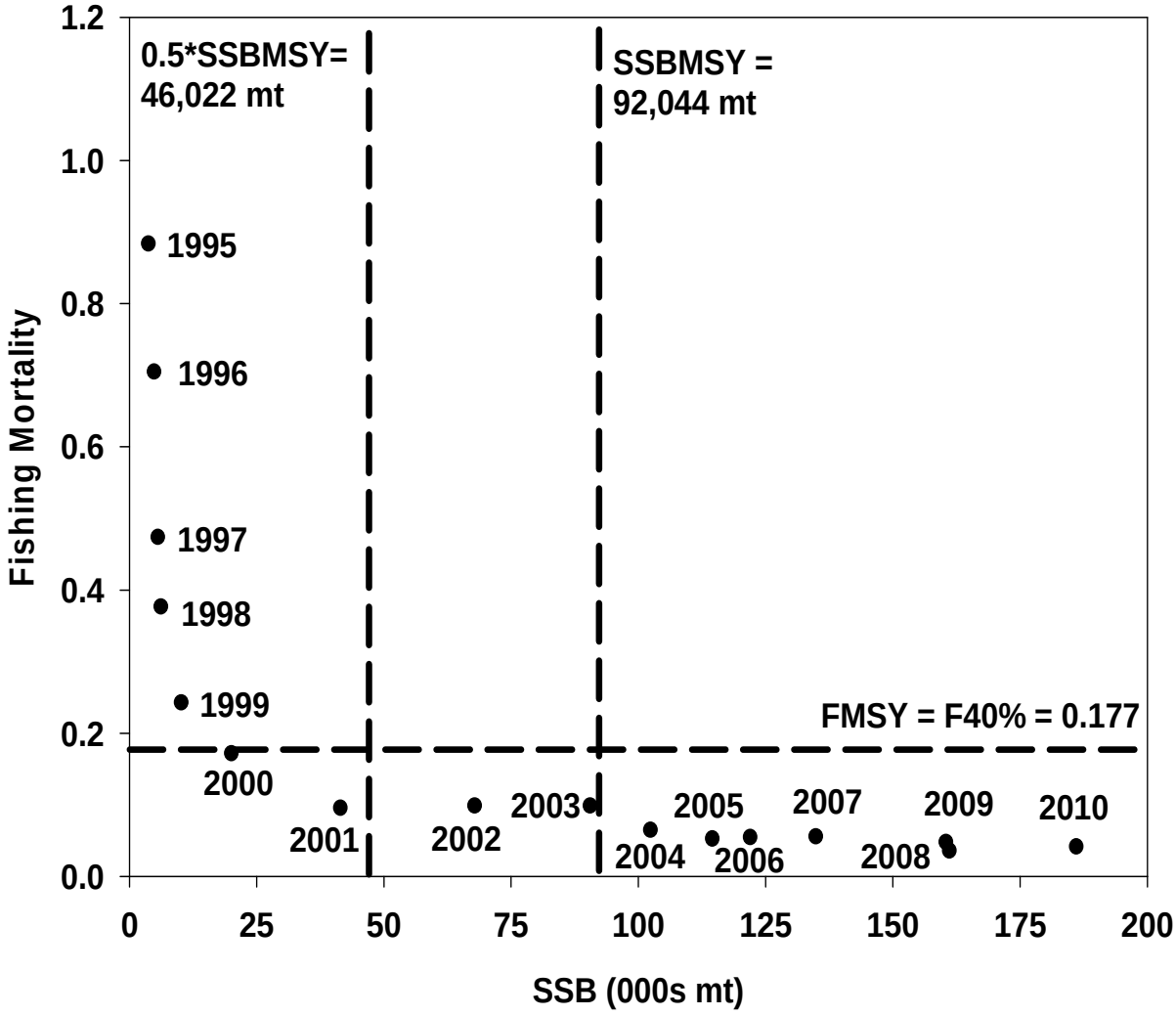


Figure 31. Status determination plot for scup.

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NOAA Technical Memorandum NMFS-NE -- This series is issued irregularly. The series typically includes: data reports of long-term field or lab studies of important species or habitats; synthesis reports for important species or habitats; annual reports of overall assessment or monitoring programs; manuals describing program-wide surveying or experimental techniques; literature surveys of important species or habitat topics; proceedings and collected papers of scientific meetings; and indexed and/or annotated bibliographies. All issues receive internal scientific review and most issues receive technical and copy editing.

Northeast Fisheries Science Center Reference Document -- This series is issued irregularly. The series typically includes: data reports on field and lab studies; progress reports on experiments, monitoring, and assessments; background papers for, collected abstracts of, and/or summary reports of scientific meetings; and simple bibliographies. Issues receive internal scientific review and most issues receive copy editing.

Resource Survey Report (formerly *Fishermen's Report*) -- This information report is a regularly-issued, quick-turnaround report on the distribution and relative abundance of selected living marine resources as derived from each of the NEFSC's periodic research vessel surveys of the Northeast's continental shelf. This report undergoes internal review, but receives no technical or copy editing.

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